

The Pacemaker
GRAPHICS

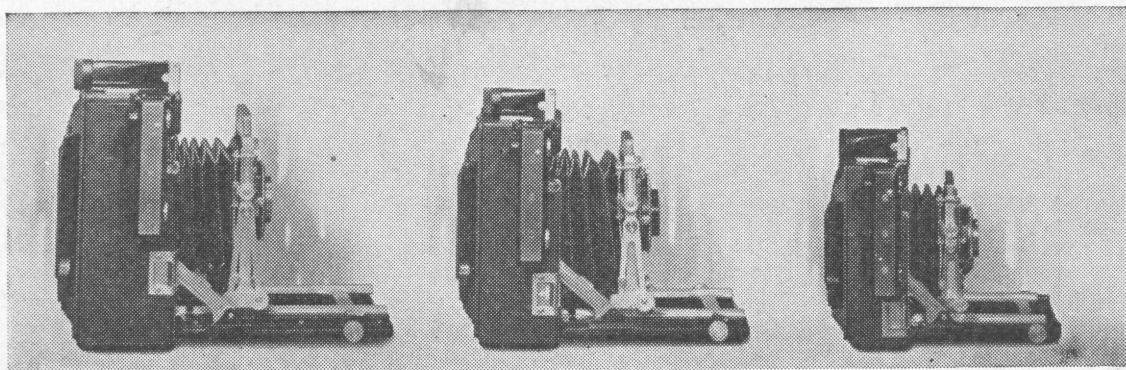
SPEED GRAPHIC AND CROWN GRAPHIC

"45" "34" "23"

INSTRUCTION AND REFERENCE MANUAL

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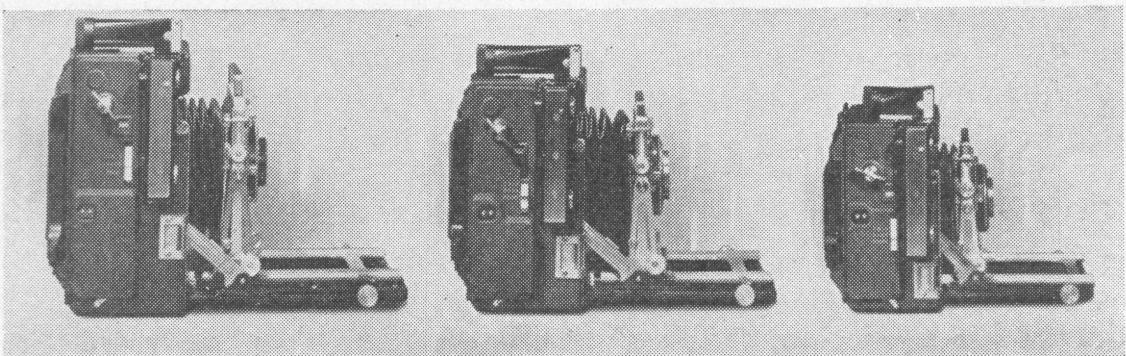
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Crown "45"

Crown "34"

Crown "23"



Speed "45"

Speed "34"

Speed "23"

Fig. 1

Important Operational Instructions Concerning the All-New Pacemaker GRAPHICS. Read Carefully to Get The Most Enjoyment From Your New Camera

You have purchased an entirely *new* camera. Before starting to use it, check it thoroughly with this manual to be sure that you will be able to utilize to the best advantage all of the careful attention to design and construction which has gone into this camera. In particular it would be well to pay close attention to the proper use of the following features:

1. Simplified GRAFLEX Focal Plane Shutter (on Speed GRAPHICS)
2. Body Release
3. Stainless steel front with provision for tilting lens on axis
4. Hinged infinity stops
5. Stainless steel open frame finder
6. Cast magnesium back with removable focusing hood

All six of the new Pacemaker GRAPHIC cameras have the same general design, construction and operational features. The Crown GRAPHIC and the Speed GRAPHIC cameras are fundamentally the same except for the focal plane shutter which is found only in the Speed GRAPHIC cameras. This booklet will cover both models, Speed and Crown, as well as all three sizes of cameras—"23", "34", and "45". These numbers are derived from the film sizes of $2\frac{1}{4} \times 3\frac{1}{4}$, $3\frac{1}{4} \times 4\frac{1}{4}$ and 4×5 accepted by the respective sizes of the Pacemaker GRAPHICS.

Your new Pacemaker GRAPHIC camera has been designed and engineered to provide you with a truly versatile and dependable camera. It includes not only the many advantages previously built into the GRAPHIC cameras but also incorporates many new features which will be described more fully in the following sections of this booklet.

The Pacemaker GRAPHIC cameras can be used for action, press, law enforcement, personal photography, the copying or photographing of small objects in actual size and of course for the making of fine portraits indoors and out. The GRAPHICS will be found to be especially useful by the working photographer who must have at hand a versatile camera capable of performing many different assignments.

A completely new simplified focal-plane shutter, for high speed photography, highlights the important features of the Speed GRAPHIC cameras. A few of the most important features of both the Speed GRAPHIC and Crown GRAPHIC cameras are: double extension bellows permitting 1 to 1 copying and the use of very long focal length lenses; all-metal interchangeable lensboards allowing the use of many different types of lenses; a locking drop bed as well as the special link track making possible critical focusing even when wide angle lenses are used; a new provision allowing the use of an infinity stop and focusing scales with wide angle lenses; and unique infinity stops providing for the use of numerous lenses, interchangeable without removing or readjusting any pair or pairs of infinity stops, thereby allowing the Pacemaker GRAPHICS to be scaled for a wide angle, a normal focal length, and a Telephoto lens.

References to the right or left side of the camera refer to parts of the camera when viewed from the back or operating position, unless otherwise stated.

Opening The Camera

With the camera firmly supported by the left hand press the small release button at the upper front corner of the left side of the camera body. The kickout spring will then push the bed forward slightly so that it may be grasped and pulled downward to the full locked position. It should not be allowed to drop down with a snap.

The front standard lock, which is in the form of a single finger pull, should then be swung directly forward unlocking the front standard and allowing it to be moved forward over the sliding track out against the two infinity stops.* In order to keep both sides of the front standard firmly against the infinity stops, when locking the front standard, grasp the lock and the side of the front standard between the thumb and the forefinger, and push the lock to the right or left until it begins to tighten. In this position the front standard will be held firmly on the sliding track by means of two flat plates forced upward against the track itself.

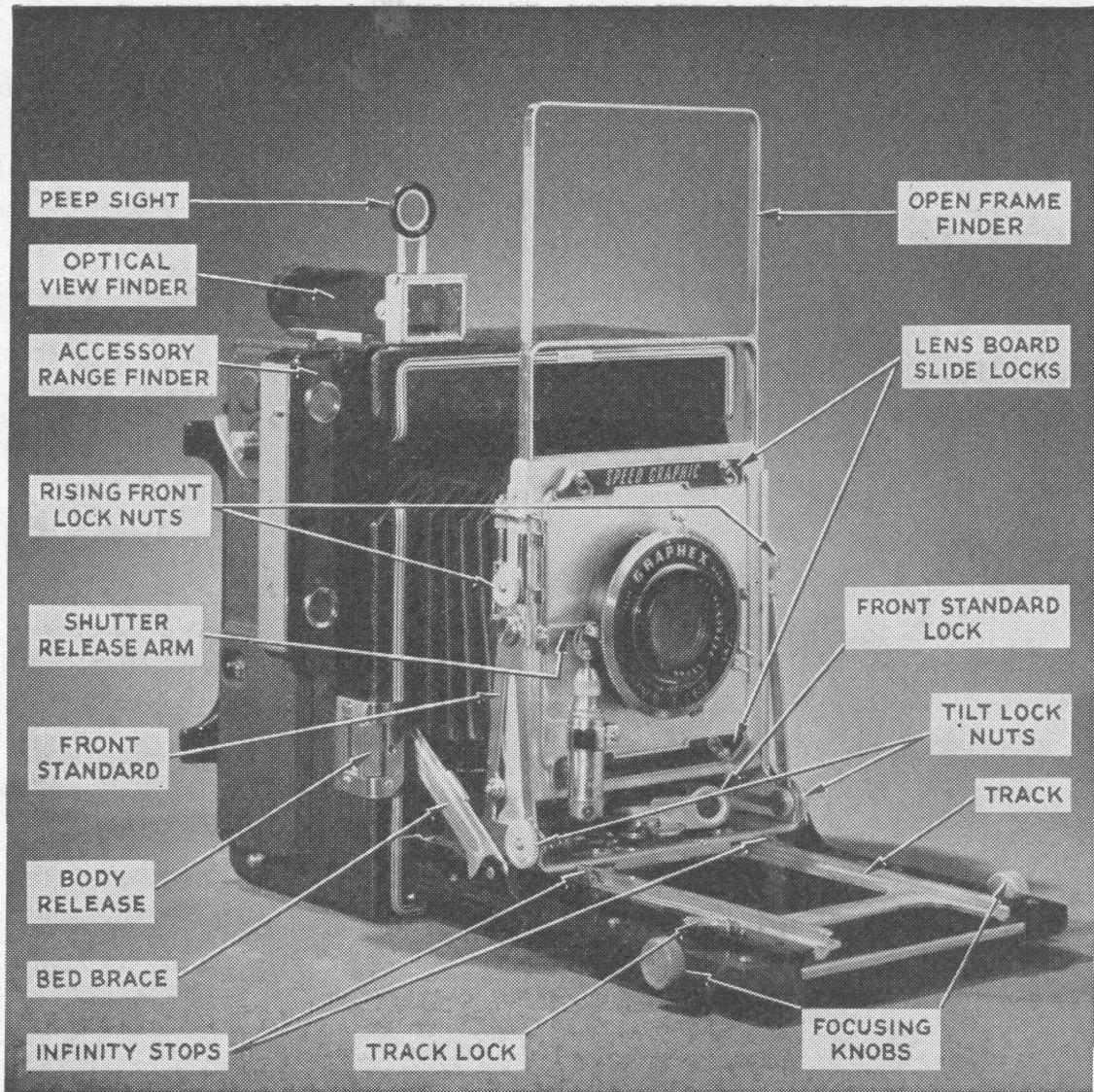
The camera is then ready for focusing upon infinity or nearby distances by means of either of the two focusing knobs located on the right and left sides of the camera bed.

To close the camera, FIRST rack the track **all the way back** into the camera body. Then unlock the front standard by swinging the finger pull forward. Move the entire front standard back into the camera body *as far as possible and lock it in place*. Depress the two braces on either side of the bed and push it upward until it snaps securely into place.

Infinity Stops

The hinged infinity stops of the new GRAPHIC cameras represent several advancements in design. As the camera was delivered to you, the infinity stops were undoubtedly in the raised position. Now with the finger move them side-ward and downward, (Figure 2), making it possible to pull the front standard forward as far as possible, even out to the full extension of the track. As shown in Figure 17, two or even more sets of infinity stops and appropriate focusing scales for lenses of varying focal length may thus be used with the Pacemaker GRAPHIC cameras.

**Note:* The stops are actually constant reference points and the lens must be focused on infinity by use of the focusing scale, the ground glass, or accessory coupled rangefinder.



The 4 x 5 Pacemaker Speed GRAPHIC

Fig. 2. The camera shown above is equipped with GRAPHEX (X) Shutter, accessory rangefinder and Solenoid Release. All operational features portrayed in this illustration (excepting the focal-plane shutter panel) are the same in the new Pacemaker Crown GRAPHIC.

Occasions may arise as a result of accident, preference in method of use or any of a number of other reasons wherein it may be desired to check the sharpness of the image carefully on the ground glass focusing screen even though the camera may be equipped with focusing scales calibrated for the lens in use. These have all been taken into consideration in your new Pacemaker **GRAPHIC** and in order to allow this careful check to be made without the necessity of moving the infinity stops they have been set back slightly from what has been known as the infinity position. Thus they may be said to be "constant reference" instead of "infinity stops" of the usual type. As a result, when the camera is opened, it will be necessary to rack the sliding track back only until the two lines indicating the infinity position on the focusing scales are properly aligned with each other. It should be noted that in order to focus the lens on any subject at a distance of more than 4 or 6 feet when the bed is opened, it is necessary to move the sliding track backward, so that this new convenience will require little, if any, change in the accustomed manner of preparing the camera for picture making.

Of course, if it is desired to move the front standard out directly to what is known as the infinity position, these infinity stops may be moved forward as desired. This is best accomplished only by a competent camera serviceman with proper equipment for squaring the front standard, relocating and relocking the infinity stops.

Focusing

With the camera bed in the horizontal position and the front standard locked against the infinity stops, the sliding track may be racked forward or backward by means of either of the two knobs at the sides of the bed. Focusing may be accomplished through the use of the focusing scale on the bed of the camera, an accessory coupled rangefinder, or by checking the sharpness of the image on the ground glass focusing screen at the back of the camera. Only the latter also permits checking for composition and depth of field. This method will be more fully discussed in succeeding sections of this booklet.

Focusing Scales

The focusing scales on the **GRAPHIC** cameras are of the modified Vernier type with one part carried on the camera bed and the other on the sliding track. The distances indicated are measured from the film plane to the subject. It will be noted that both of the scales carry duplicate distance markings for the

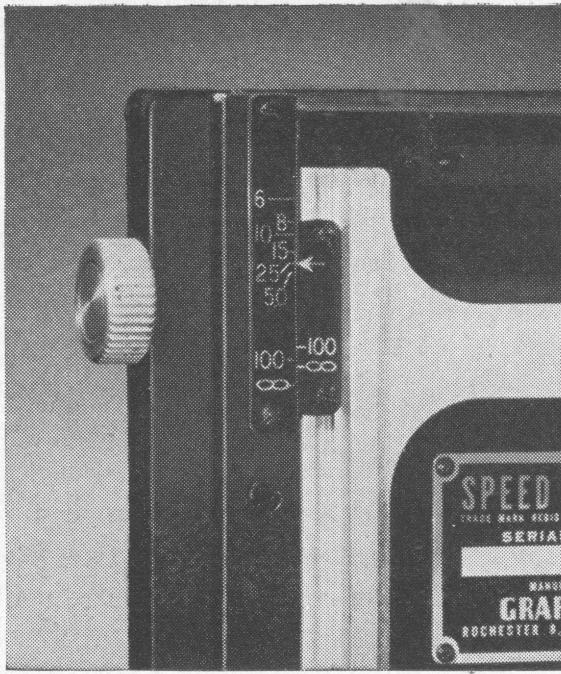


Fig. 3. Modified Vernier Focusing Scales

greater distances. To use one of these settings, turn the focusing knob until the lines corresponding to the desired distance on both parts of the focusing scale lie directly opposite each other. For closer distances, the pointer at the front of the movable scale should be placed directly opposite the line indicating the desired distance on the stationary scale. This type of scale is easier and quicker to read than

the full Vernier or a standard type scale with a single movable index line.

The lens of your camera has been supplied with the focusing scale calibrated especially for it. To use this scale with any other lens, even of the same make, speed and rated focal length, may result in out-of-focus pictures.

When several lenses are to be used interchangeably on the camera, new infinity stops and Vernier scales can be fitted to the camera bed. However, the proper scaling of a lens requires special equipment and it is best done only at one of the authorized GRAFLEX Service Departments.

At the right front corner of the camera bed of the larger GRAPHIC cameras will be found a track lock in the form of a lever. Because of space limitations in the GRAPHIC "23" cameras, there is a small set screw which may be adjusted to provide desired tension of the focusing track. The lever of the larger cameras may be pulled outward in order to produce desired tension on the track. If pulled firmly around as far as possible, it will lock the track so that it cannot be moved accidentally. Remember that this must be unlocked before attempting to turn the focusing knob since otherwise the bed mechanism is likely to be damaged.

Rangefinder

If the camera is fitted with a coupled rangefinder, it will not be necessary to refer to the focusing scale or to the ground glass for focusing. The rangefinder

will be of the coincidental type. By looking through the window at the rear of the rangefinder it will be possible to see two distinct areas, one lying within the other. As the lens is focused in the normal manner, the rangefinder mechanism will be operated in such a way as to cause the centrally located image to move vertically. When the image in this area exactly coincides with the image in the larger area, the rangefinder will be in correct adjustment for that subject or any other subject matter at an equal distance from the camera. If the lens on the camera is the one for which the rangefinder was originally adjusted, it will then be in focus and the exposure may be made with full assurance that the image will be critically sharp in the finished picture.

Ground Glass Focusing

All GRAPHIC cameras are equipped with a ground glass focusing panel at the back of the camera. In the GRAFLEX back this is in the form of a separate removable GRAFLEX focusing panel, now supplied as a standard part of the camera. In the GRAPHIC back this focusing panel will be found permanently attached by means of springs at the top and bottom.

The ground glass is made accessible by pressing inward on the small latch at the back. This will allow the four-sided all-metal viewing hood to spring open. If it is desired to examine the corners or sides of the ground glass area directly with or without the aid of a magnifying glass the viewing hood may be removed easily by pressing outward on either of the two clips or springs at

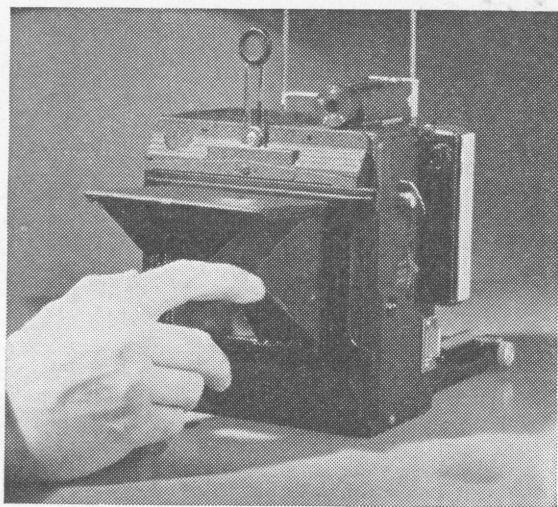


Fig. 4. Viewing hood may be closed with one hand.

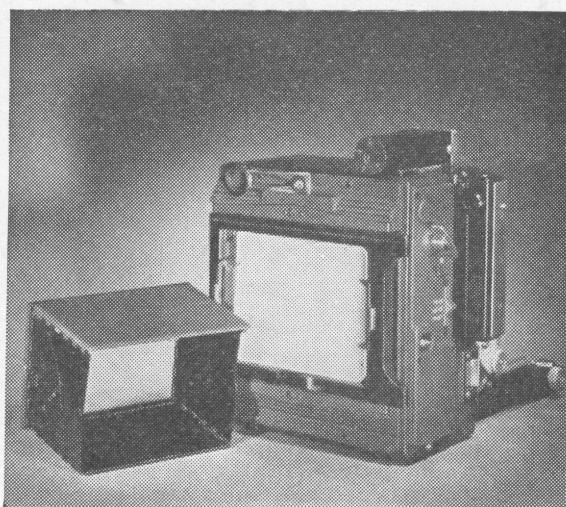


Fig. 5. Four sided all-metal removable viewing hood.

the sides of the panel. It will be found easier to remove this viewing hood if it is in the open position rather than closed. In order to see the image on the ground glass focusing screen, it will be necessary to open both the front and focal plane shutters by setting them to the T and O positions as directed in the sections devoted to those shutters.

To close the viewing hood press inward with the thumb and the forefinger on the two lower side members and upward on the long lower section. Move this all of the way upward into the back of the camera and then fold the top door down until it latches. See Figure 4.

In the event that the top door and its attached wings spring free, fold the lower flap all of the way up, swing the wings in against the top door and pull it down to latch. Upon release, the hood will spring open properly.

The ground glass focusing screen will make it possible to check the sharpness of the image by moving the lens forward or backward by means of the focusing knob on the bed of the camera. Closing the diaphragm from the full open position will also make it possible to determine the depth of field which will be included in the finished picture. After ground glass focusing has been accomplished, lock the sliding track with the track lock mentioned before. Remember to close and cock the shutter which is to be used for the making the exposure before inserting the film attachment into the camera.

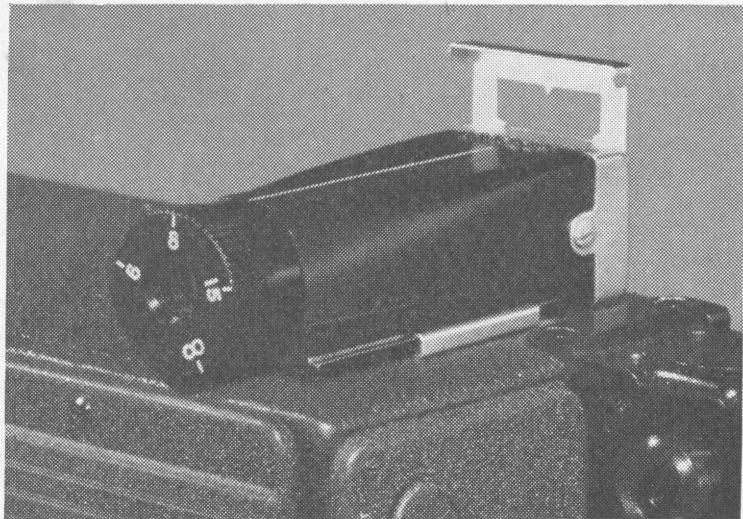
Viewfinders

Composition of the subject matter may be accomplished by any one of three different methods with the GRAPHIC cameras. The ground glass focusing screen has already been discussed.

Your Pacemaker GRAPHIC has two types of viewfinders, either of which may be used when it is inconvenient to refer to the ground glass.

Viewfinders in general should not be relied upon to give an exceedingly accurate indication of the amount of subject matter to be secured on the negative, since the amount of subject matter which will be seen depends largely upon the position at which the observer holds his eye—a factor which varies considerably between individuals and is greatly influenced by whether or not the user wears glasses. The optical viewfinder is often preferred in order to define the limits of the field since this finder may be fitted with masks of different sizes. However, many photographers prefer the open framefinder for all types of photography rather than merely for action photography. Both finders are used to best advantage when the eye is held as close as possible to the rear element.

Fig. 6. Optical Tubular Viewfinder. Removable from camera. Adjustment for parallax and masks for use with lenses of different focal lengths.



Tubular Viewfinder

The optical tubular viewfinder fitted to the top of the camera consists of a special molded die cast magnesium housing fitted to its mounting shoe attached to the camera body. It includes improved optics and a special adjustment to compensate for vertical and horizontal displacement parallax of the finder with respect to the axis of the lens. The small dial at the back of the finder has four markings which can be aligned with the white line at the top of the finder. Notches assist in locating these four points so that subjects at distances of 6, 8, 15 feet and infinity will be properly centered by the camera lens on the film plane when the subject is centered in the finder. In order to utilize this feature fully be sure to line up the eye with the center of both the front and rear lenses of the viewfinder.

In order to properly define the limits of the field which the lens will include on the film, the front of the finder may be fitted with masks of various sizes. Figure 6 shows one of these masks partially inserted. As indicated in the following table, masks are available to correspond with the fields covered by lenses of normal and long focal lengths, including telephoto lenses. No masks are provided for wide angle lenses since the optical system of the finder does not include a large enough field.

Should it be desired to remove the optical viewfinder from the top of the camera, depress the flat spring located at the left side of the front of the finder. Then slide the entire finder forward out of its mounting shoe.

Table Showing Standard Masks and Lenses Served by Each on Various GRAPHIC Cameras

2 $\frac{1}{4}$ x 3 $\frac{1}{4}$	3 $\frac{1}{4}$ x 4 $\frac{1}{4}$	4x5	Mask Number
	4 $\frac{1}{2}$ " — 4 $\frac{3}{4}$ "	5" — 5 $\frac{7}{8}$ "	4
3 $\frac{1}{4}$ " — 3 $\frac{7}{8}$ "	4 $\frac{13}{16}$ " — 5 $\frac{1}{4}$ "	5 $\frac{15}{16}$ " — 6 $\frac{3}{8}$ "	3
3 $\frac{5}{16}$ " — 4 $\frac{1}{2}$ "	5 $\frac{5}{16}$ " — 6"	6 $\frac{7}{16}$ " — 6 $\frac{5}{8}$ "	2
4 $\frac{9}{16}$ " — 5"	6 $\frac{1}{16}$ " — 7"	6 $\frac{11}{16}$ " — 8 $\frac{1}{2}$ "	9
5 $\frac{1}{16}$ " — 6"	7 $\frac{1}{16}$ " — 8"	8 $\frac{9}{16}$ " — 9 $\frac{1}{2}$ "	10
6 $\frac{1}{16}$ " — 7 $\frac{1}{2}$ "	8 $\frac{1}{16}$ " — 8 $\frac{1}{2}$ "	9 $\frac{9}{16}$ " — 10 $\frac{1}{2}$ "	11
7 $\frac{9}{16}$ " — 7 $\frac{3}{4}$ "	8 $\frac{9}{16}$ " — 12"	10 $\frac{9}{16}$ " — 13 $\frac{1}{2}$ "	8
7 $\frac{13}{16}$ " — 9 $\frac{1}{2}$ "	12 $\frac{1}{16}$ " — 13 $\frac{7}{8}$ "	13 $\frac{9}{16}$ " — 15"	7
9 $\frac{9}{16}$ " — 11 $\frac{7}{8}$ "	13 $\frac{15}{16}$ " — 16"	15 $\frac{1}{16}$ " — 16 $\frac{7}{8}$ "	6
11 $\frac{15}{16}$ " — 13"	16 $\frac{1}{16}$ " — 20"	16 $\frac{15}{16}$ " — 20"	5

Open Finder

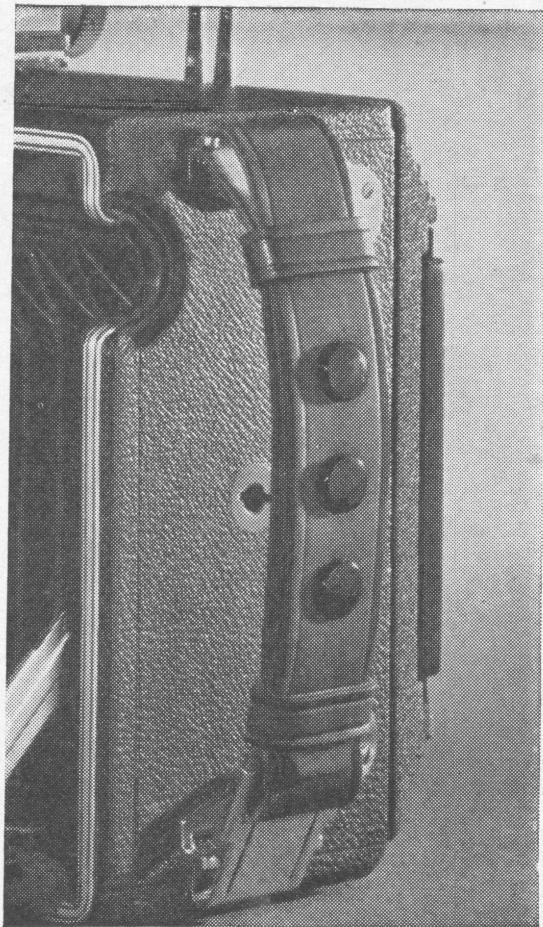
The open frame finder of the new GRAPHIC camera is of an entirely new construction. It consists of two stainless steel sections telescoping almost entirely into the front standard of the camera but designed so that it may be drawn upward readily into the full open position. Since the upper section is almost entirely contained within the lower member, it will be found easier to pull the lower section upward first. This will permit easier access to the knurled finger grips on the upper section which should be pulled up as far as possible. This finder is fitted with click stops indicating parallax adjustment settings for six feet, fifteen feet, and infinity. To adjust it correctly for parallax, move the entire finder by pressing up or down on the lower cross member until the desired setting is attained as indicated by the markings on the right side of the finder. Click settings help to position this quickly and accurately. When the rear peep sight is lifted or swung upward from its recessed position in the back of the camera, the open frame finder is ready for use.

This finder is usable with normal and long focal length, but not telephoto or wide angle lenses.

The Adjustable Handle

In order to provide a tight or loose grip as may be preferred, the handle of the Pacemaker GRAPHIC camera has been designed to allow adjustment to custom fit your hand. If you desire a good tight handle, merely take up on the snap buttons. Conversely, to loosen the handle, extend it and resnap the buttons.

Fig. 7. Adjustable Handle to custom-fit hands of different sizes.



To unhook the entire handle in order to provide access to the tripod socket in the side of the camera, press inward on the spring or leaf at the base of the handle. It will then be possible to slip the entire clip off the lug at the bottom of the camera.

Holding The Camera

The strap, on the side of the camera housing opposite to that on which the focal-plane shutter controls are located, is designed for holding the outfit in use as well as for carrying it when not in its case. Holding this in the left hand or slipping the hand under the strap and gripping the edge of the body (as you prefer), leaves the right hand free for focusing, shutter operation, and film changing. Bracing your arms against your body will increase the steadiness with which you can hold the camera and therefore increase the sharpness of your negatives, especially those exposed at the slower shutter speeds.

Body Release

All of the new Pacemaker **GRAPHIC** cameras have a built-in body release located at the lower right corner of the front of the camera. This is an entirely new feature and its convenient location makes it possible to trip either the front or focal-plane shutter by squeezing the release lever with the forefinger while holding the camera firmly with both hands.

The body release is connected to the front shutter by means of a special type cable which employs the principle of compression of the outer stationary member and tension of the inner cable. This cable is concealed beneath the bellows by straps which control its folding when the camera is closed, yet allow easy transfer of pressure from the body release to the shutter release lever on the front of the camera, whether the front shutter is in the normal position or in the fully extended position such as is used for the photographing of small subjects in actual size.

Pressing inward on the body release activates the internal part of the cable and it in turn pulls downward on a plunger attached to the front standard of the camera. Attached to this plunger is a shutter release arm which in turn presses against the release lever of the front shutter. When changing from one lens and shutter combination to another, it should be noted that shutters of different sizes require different shutter release arms. New lensboard kits may be purchased from **GRAFLEX** dealers. Each kit includes a precision cut lensboard for a specific lens and shutter, the appropriate shutter release arm for the plunger on the front standard, and the necessary light-excluding felt washer for the locating pin of the shutter. The release arms are held in place on the plunger by means of a small set screw and can be easily and quickly positioned in such a way as to insure easy and accurate tripping of the front shutter.

Shutter Selector Slide

The selector slide at the right side of the focal plane shutter mechanism of the **Speed GRAPHIC** cameras is provided in order to allow the body release to operate selectively either the focal-plane or the front shutter. When this slide is pressed inward and pulled down so that the raised portion is opposite the word FRONT, the body release will trip the front shutter. Pressing this slide inward at the bottom and moving it up until the raised portion is opposite the word BACK will allow the body release to operate the focal plane shutter. When the slide is pressed inward at the bottom and moved all of the way upward to

the word TRIP it will trip the focal plane shutter directly without the use of the body release. This will be discussed more fully below. The shutter selector thus makes it impossible to release the focal plane shutter after the camera has been readied for operating the front shutter by means of the body release.

Camera Shutters

All of the Pacemaker GRAPHIC cameras are normally equipped with a between-the-lens front shutter. All of the Speed GRAPHIC cameras have the additional focal-plane shutter at the back of the camera. This shutter permits the making of very short exposures up to 1/1000 of a second.

It is rather difficult to make a definite recommendation as to which shutter should be used at any given time. Focal-plane shutters are especially efficient at the higher speeds and the GRAFLEX focal-plane shutters are unexcelled for high speed photography. The front shutter is necessary for speeds slower than 1/30 of a second and for synchronization with standard flash lamps since the focal plane shutter requires the use of the long peak flash lamps. With the exception of somewhat greater efficiency at the faster speeds, a given shutter speed setting will produce the same exposure whether the focal plane or front shutter is used. Many photographers prefer to use the front shutter throughout its entire range of speeds, while others find it convenient to use the focal-plane shutter for speeds of 1/100 and faster. The new body release now makes it unnecessary to use a different method of operation for the front and back shutters. Thus it is a simple matter to use either shutter at will, and the choice of which shutter to use must remain a matter of personal preference at the option of the individual photographer.

Focal-Plane Shutter

The focal-plane shutter of Pacemaker Speed GRAPHIC cameras consists essentially of a durable light tight curtain having four rectangular openings or slits of different widths. The ends of the curtain are wound on rollers at the top and bottom of the camera and in making the exposure, the selected opening passes in front of the film as it moves downward from the top to the spring loaded bottom roller. The exposure time is governed by the width of this opening and the speed with which it passes across the film. This latter control of exposure time is accomplished by means of a governor of entirely new design and principle. Through the use of the governor any one of the three smaller apertures in the curtain can be made to pass across the film at either of two different rates of

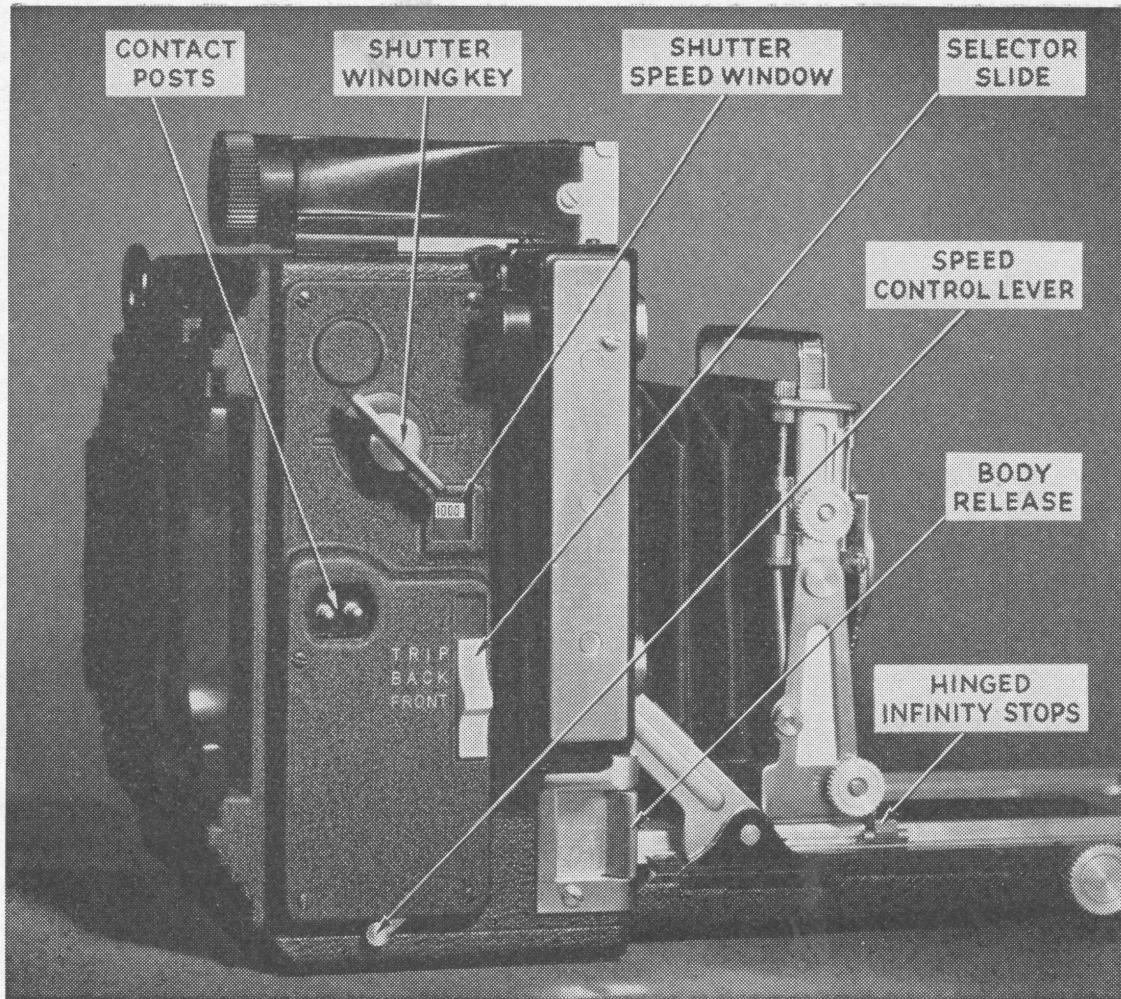


Fig. 8. GRAFLEX Focal-Plane Shutter, Selector Slide and Synchronizer Outlet.

speed thus providing six different shutter speeds. The fourth or full open position is used for focusing and the making of Time exposures. The governor which is engaged or disengaged by the shutter speed control lever at the bottom of the shutter mechanism housing is of such a design that it insures smooth and even travel of the shutter curtain across the opening at the back of the camera. The accuracy of the shutter speeds thus produced is within the recommendations of the American Standards Association.

The controls for the focal-plane shutter are located at the right side of the camera as it is normally viewed from the back. (See figure 8). The speeds produced by this shutter may be read directly in the shutter speed window

next to the large winding key. The shutter speed control lever which is used to engage or disengage the governor also controls the location of a mask in the shutter speed window. When the lever is moved toward the back of the camera the mask in the window will be raised and will expose the following figures as the shutter is wound: 60, 250, 1000. With the lever moved forward to engage the governor the following figures will be seen in the shutter speed window as the shutter is wound: 30, 120, 500. These figures correspond to the exposure times in terms of fractional parts of a second.

The focal plane or back shutter may be released by either of two methods. When the shutter selector is in the central position with the raised portion opposite the word BACK, tripping the body release will allow the focal-plane shutter to run down from one setting to another producing the shutter speed indicated in the shutter speed window. The shutter may also be released by pressing inward and upward on the bottom of the shutter selector slide. Be sure that this slide is pulled down opposite the word BACK after the curtain has been allowed to run down to the desired setting.

To maintain peak efficiency of the focal-plane shutter it is advisable to allow the curtain to run down to the Open or fully closed position before putting the camera away.

Time Exposures

The GRAFLEX focal plane shutter may be used for the making of Time exposures. Move the speed control lever towards the back of the camera to disengage the governor. Wind or release the focal plane shutter until the letter T appears in the shutter speed window. When making Time exposures it is preferable to release the shutter by means of the body release or a special cable release threaded into the cable release socket of the body release. Pressure on the body release will allow the focal-plane shutter to run down to the full Open position showing the letter O in the shutter speed window. To terminate the exposure the body release should again be pressed, thus allowing the shutter to close. Remember that it is necessary to have the front shutter open when using the back shutter. Conversely the focal-plane shutter should be set at O (Open) when the front shutter is used.

CAUTION: Because one of the curtain apertures passes in front of the negative material each time the curtain is moved (either in winding it or releasing it) it is necessary to protect the film from unintentional exposure by placing the slide in the film holder or closing the front shutter. Otherwise injurious fogging of the film is liable to result.

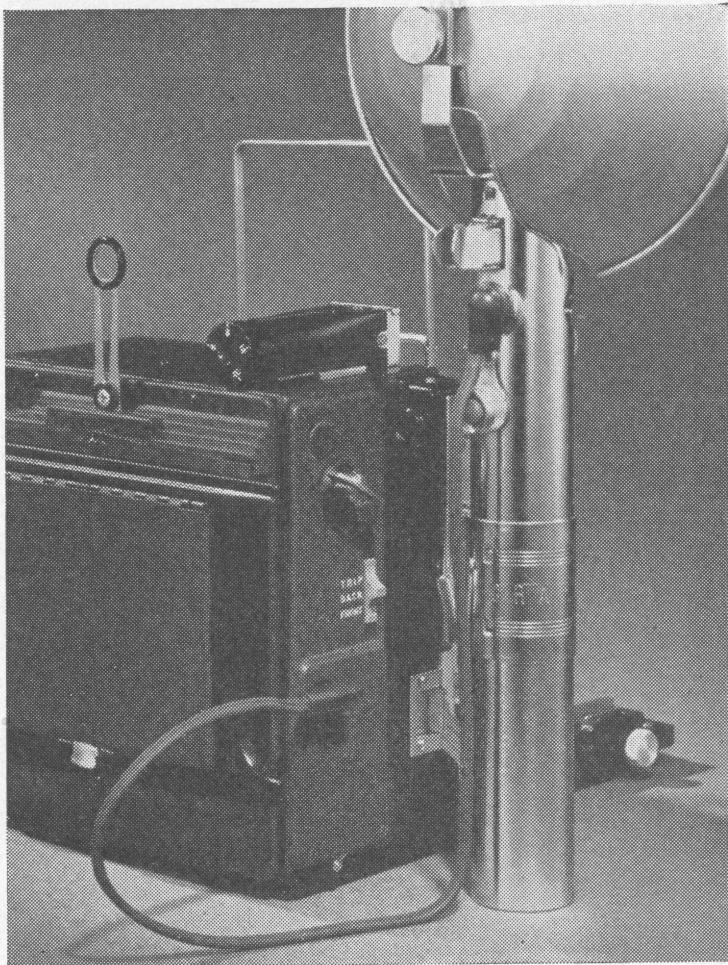


Fig. 9. Focal-Plane Shutter Synchronization built-in as standard feature. A-20 cord attaches to series outlet in battery case.

If it is desired to operate the focal-plane shutter with a cable release be sure to use a sturdy unit such as the heavy duty all-metal cable release supplied as an accessory for use with the Speed GRAPHIC cameras.

Focal-Plane Shutter Flash Synchronization

The focal-plane shutters of all of the Pacemaker Speed GRAPHIC cameras incorporate built-in flash synchronization. The contact posts or outlets will be found at the left side of the shutter housing below the shutter winding key.

Since the focal-plane shutter exposes the negative area progressively as the opening in the shutter curtain passes down across the film, it is necessary to use only certain shutter speeds and only those flash lamps which have a long useful flash duration. With the exception of time exposure, neither GRAFLEX nor the manufacturer of the flash lamp will guarantee consistent, even, illumination of the negative if other than the lamps recommended herewith are used.

Because of the different widths of film used in the three Pacemaker Speed GRAPHIC cameras the length of curtain travel is different in each size. Hence, instructions for flash synchronization with the Speed GRAPHIC "23" cameras vary slightly from those for the larger Speed GRAPHIC "34" and "45" cameras. Full details will be found in the following paragraphs.

In the Speed GRAPHIC "23", the shutter speeds of 1/1000, 1/500 and 1/250 may be synchronized with the No. 31 Photoflash and No. 2A Superflash lamps which have the necessary long peak of flash to provide even exposure of the entire negative at these shutter speeds. We do not recommend that flash lamps be used with the other instantaneous speeds and these are marked in red as a reminder that they are not to be used for flash synchronization.

For the Speed GRAPHIC "34" and "45" Cameras only the No. 31 Photoflash and the No. 2A Superflash lamps are suitable. They may be satisfactorily synchronized at speeds of 1/1000, and 1/250. Because the duration of the useful peak of flash of the No. 31 and No. 2A lamps is usually shorter than the elapsed time required for the opening of the shutter at the 1/500 setting to pass across the film, the 1/500 setting should be used with such lamps only when uniform density over the entire negative is not of primary importance. Other speeds are marked in red as a reminder that they are not to be used for flash synchronization.

All flash lamps as well as high speed units may be used with the Time Exposure setting by the means of the built-in contacts. The curtain should be set for making a Time exposure as previously outlined in this booklet, and the lamp will be fired as the curtain reaches the full Open position.

When using focal plane shutter flash synchronization the A-20 connecting cord should be attached to the outlet in the side of the shutter housing. The other end of this cord should be inserted into the series outlet in the back of the GRAFLEX battery case. This outlet is made available when the red push button is unscrewed and swung down out of the way.

A secondary switch connected to the body release makes it necessary to release the focal-plane shutter by the body release in order to fire the bulb. Thus the GRAFLEX focal-plane shutter is designed to prevent the firing of flash lamps by winding the shutter winding key or by releasing the shutter with the shutter selector slide.

The Synchronized GRAPHEX and GRAPHEX (X) Shutters

The GRAPHEX Shutter is a rim set shutter having nine speeds from 1 to 1/400 second and including "Time" and "Bulb". The knurled collar or rim carries the designations T, B, 1, 2, 5, 10, etc., with these numbers corresponding to instantaneous exposures of 1, 1/2, 1/5, 1/10 second, etc. To adjust the shutter to produce any one of these speeds turn the knurled rim on the outside of the shutter until the desired figure or setting is directly above the arrow appearing at the top or top right on the face shutter. The speed setting may be changed before or after cocking the shutter but it is more easily accomplished before cocking. Settings between the marked speeds will not give intermediate exposure times. When turning the knurled rim to 1/400 a slight additional pressure will be required to overcome the resistance of a booster spring.

Facing the shutter the cocking lever will be found on the upper right side. The release lever will be found at the upper left side. To prepare the shutter to make an exposure, move the cocking lever in a clockwise direction as far as possible. Pressure on the release lever will then allow the shutter mechanism to operate. Always trip the shutter before putting the camera away.

The GRAPHEX Shutter must be cocked for "Time" and "Bulb" as well as for instantaneous exposures. To make a "Time" exposure, set the shutter on "T" and cock it. Press the release lever once to open the shutter and again to close it. For a "Bulb" exposure set the shutter on "B" and cock. The blades will remain open while pressure is maintained on the release. A cable release attached directly to the shutter and a sturdy tripod should always be used for "Time" and "Bulb" as well as instantaneous exposures slower than 1/50 second. Do not recock shutter when set on "T" and blades are open.

The GRAPHEX Shutters carry the diaphragm markings for the lenses. The aperture scale indicating the diaphragm openings of from f/4.5 or f/4.7 to f/32 will be found at the left side of the face plate of the shutter. The aperture indicator is at that point and it allows setting the diaphragm as desired.

If desired, a cable release may be used to operate the GRAPHEX Shutter. Screw it into the socket at the left of the cocking lever and apply pressure to it instead of the shutter release lever as directed above.

The GRAPHEX Shutters have a Press Focus Lever which will be found on the right side of the shutter housing. After the shutter has been cocked this lever may be pushed inward to cause the shutter blades to open for ground glass focusing. This action eliminates the necessity of resetting the shutter to "Time" and opening the shutter blades, with the necessary reverse procedure

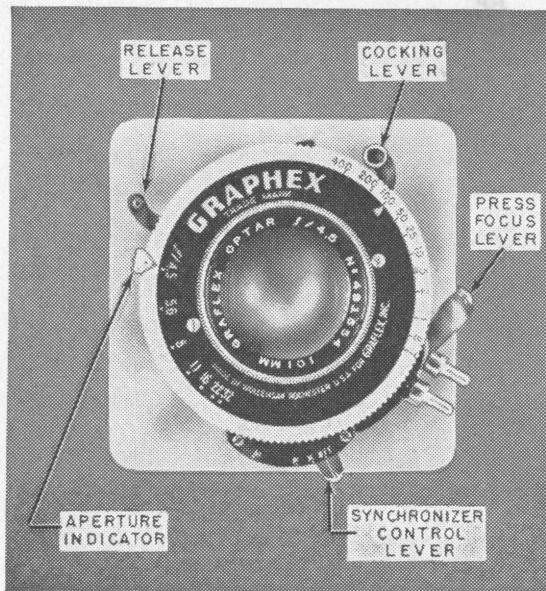


Fig. 10. Fully synchronized GRAPHEX shutter, with synchronizer contact posts at lower right.

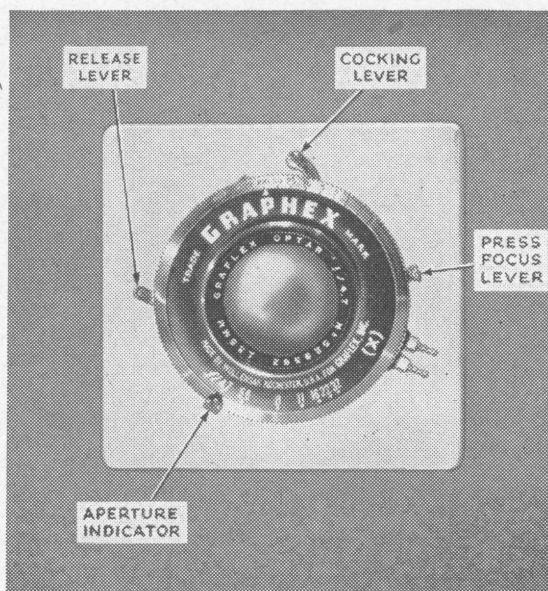


Fig. 11. GRAPHEX (X) Shutter.
Built-in Synchronization for high
speed lamps only. Requires sole-
noid for standard flash lamps.

in order to again prepare the shutter for the making of an instantaneous exposure. After focusing has been accomplished merely move the lever outward and the shutter will be ready for immediate operation. This lever will not function unless the shutter is cocked, and it does not interfere in any way with the normal operation of the shutter.

Flash Synchronization With The Synchronized GRAPHEX Shutters

Special built-in mechanism allows synchronization with flash lamps without the use of an external tripper. The built-in gear train producing this synchronization is controlled by a special dial setting arrangement extending downward from the lower portion of the shutter. The synchronizer control lever on this dial setting scale has click stops to permit accurate settings for synchronization at the points indicated. This control lever adjusts the delay of the operation of the shutter to correspond with the correct ignition lag of the lamp being used. Set the lever to correspond to the type of lamp which is being used.

The following table indicates the types of some of the more widely used flash lamps.

TYPE X	High speed electronic units not tripped by relay or solenoid.	
TYPE F (5 millisecond) gas filled	SM, SF	Bayonet Base
TYPE M (20 millisecond) wire or foil filled	No. 5, Press 25 No. 11, 22, 2, Press 40 etc.	Bayonet Base Screw Base

To use the built-in synchronization feature, attach the flattened right angle connection of the A-20 connecting cord to the contact posts on the shutter and plug the other end into a series outlet generally found in the back of a battery case. In the GRAFLEX Flash Synchronizer battery case this outlet is reached by unscrewing and swinging down the red push button switch. Set the synchronizer control lever to the correct position and cock the shutter in the usual manner. Synchronization will be automatically accomplished as the shutter is tripped with the Body Release in the normal manner.

The "X" setting provides instantaneous contact when the shutter blades reach the open position and is intended to be used for synchronization with high speed electronic flash units not incorporating a separate solenoid or relay. When using one of these units, connect its cord to the contact posts on the shutter, set the synchronizer control lever at "X" on the dial, and cock the shutter. The tube will then flash in synchronization with the opening of the shutter as the Body Release or shutter release lever is operated in the normal manner.

When using the "X" setting of the shutter for high speed lamps be sure to follow carefully the wiring circuit or special instructions which may be given by the manufacturer of the lamp so as to insure proper synchronization and to avoid damage to the shutter. The contacts in these shutters are designed to operate electronic flashing units which are triggered by electronic means similar to the Thyratron or Strobtron tubes. It is not recommended that they be used with units using built-in relay triggering circuits.

When flash lamps are not being used, the synchronizer mechanism may be disengaged entirely by moving the control lever to the "Off" position.

Flash Synchronization With The GRAPHEX (X) Shutters

In appearance the GRAPHEX (X) shutter is quite similar to the fully synchronized GRAPHEX Shutter. It may be identified by the letter (X) on the face plate

next to the contact posts and it lacks the dial setting arrangement and built-in mechanism for producing synchronization with standard flash lamps. The two contact posts extending from the side of the shutter are connected to an internal switch and are intended to be used only with high speed, gaseous discharge tube units which do not have a built-in relay or solenoid.

When using one of these units, connect its cord to the contact posts on the shutter, and cock the shutter. The tube will then flash in synchronization with the opening of the shutter as the Body Release or shutter release lever is operated in the normal manner.

The contacts in these shutters are designed to provide instantaneous contact when the shutter blades reach the open position and are intended to be used for synchronization with high speed electronic flash units not incorporating a separate solenoid or relay. For full details concerning any high speed unit be sure to obtain full wiring or circuit data from the manufacturer of the lamp in question.

Do not attempt to fire standard flash lamps using the internal contacts of this shutter inasmuch as such lamps will not be fired in synchronization with the operation of the shutter. Synchronization with standard flash lamps is effected through the use of a solenoid or other external synchronized tripper.

The GRAFLEX solenoid may be left in position at all times on the Pacemaker GRAPHIC cameras since there is no interference between it and the Body Release.

The Flash Supermatic And Supermatic (X) Shutters

The Supermatic Shutter is a rim set shutter having 9 speeds from 1 to 1/400 second, and including "Time" and "Bulb". The larger No. 3 Supermatic Shutter has 8 speeds from 1 to 1/200 seconds. The speed scale is on the upper part of the face plate of the shutter, and is divided into two sections, each with its own pointer on the knurled rim or collar of the shutter. To adjust the shutter to produce any one of these speeds, turn the knurled rim on the outside of the shutter until the appropriate pointer is opposite the desired speed setting. When the slower speeds as well as "Bulb" and "Time" are used, the camera should be on a firm support. The speed setting may be changed before or after cocking the shutter, but is more easily accomplished before cocking. Settings between the marked speeds will not give intermediate exposure times.

Facing the shutter the cocking lever will be found at the top, and the release lever will be found at the upper left side. To prepare the shutter to make an

exposure move the cocking lever in a clockwise direction as far as possible. Pressure on the release lever will then allow the shutter mechanism to operate. Always trip the shutter before putting the camera away.

The Supermatic Shutter must be cocked for "Time" and "Bulb" as well as for instantaneous exposures. To make a "Time" exposure, set the pointer opposite the letter "T" and cock the shutter. Press the release lever once to open the shutter and again to close it. For a "Bulb" exposure set the pointer opposite "B" and cock the shutter. The blades will remain open while pressure is maintained on the release. A cable release and a sturdy tripod should always be used for "T" and "B" as well as instantaneous exposures slower than 1/50 of a second.

The Supermatic Shutters carry the diaphragm markings for the lenses. The aperture scale indicating the diaphragm openings of from f/4.5 or f/4.7 to f/32, will be found at the bottom of the face plate of the shutter. The aperture indicator is at that point and allows setting the diaphragm at the desired position. Click stops are provided to facilitate quick and accurate setting of the diaphragm.

The Press Focus Button will be found over the right hand or slower speed scale. After the shutter has been set for any speed and cocked, this button should be pressed inward and held down as the shutter is released by the release lever. This will cause the shutter blades to open and remain in this position permitting ground glass focusing. This action eliminates the necessity of resetting the shutter to "Time" and opening the shutter blades, with the necessary reverse procedure in order to again prepare the shutter for the making of an instantaneous exposure. After focusing has been accomplished, merely recock the shutter in the normal manner and it will be ready for immediate operation.

Flash Synchronization With Flash Supermatic Shutters

Special built-in mechanism allows synchronization with flash lamps without the use of an external tripper. The built-in gear train producing this synchronization is controlled by the location of the synchronizer adjustment screw on the face of the shutter and the synchronizer cocking lever at the upper right side of the shutter. This was the lever used to cock the self-timing mechanism in earlier models of this shutter. The *synchronizer cocking lever must be moved clockwise as far as possible* to cock the built-in synchronization mechanism, otherwise the flash bulb will not fire when the shutter is released. The table given below indicates the types of some of the more widely used flash lamps.

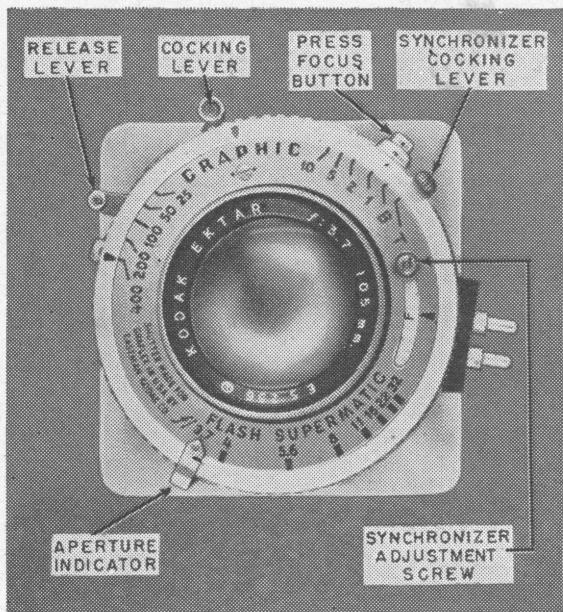


Fig. 12. Flash Supermatic Shutter. Full built-in synchronization for standard flash and high speed lamps.

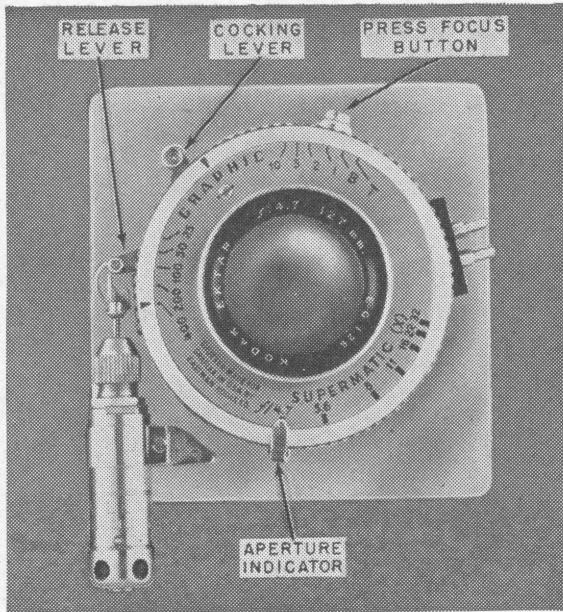


Fig. 13. Supermatic (X) Shutter. Built-in synchronization for high speed lamps only. Requires solenoid for standard flash lamps.

TYPE X

TYPE F (5 millisecond)

Gas filled

TYPE M (20 millisecond)

wire or foil filled

High speed electronic units not tripped by relay or solenoid.

SM. SF

Bayonet Base

No. 5, Press 25

Bayonet Base

No. 11, 22, 2, Press 40 etc.

To use the built-in synchronization feature, attach the flattened right angle connection of the A-20 connecting cord to the contact posts on the shutter and plug the other end into a series outlet generally found in the back of a battery case. In the GRAFLEX Flash Synchronizer battery case this outlet is reached by unscrewing and swinging down the red push button switch.

Loosen the synchronizer adjustment screw and move it to align the letters "M" or "F", depending on the type of lamp being used, with the synchronizer adjustment indicator. Be sure to tighten the adjustment screw securely. Set the aperture pointer; adjust the shutter speed rim and cock the shutter as usual; then cock the synchronizing lever, moving it as far as possible. The shutter is then ready to provide positive synchronization with the type of flash lamp for which it has been adjusted. Release the shutter in the normal manner with the Body Release. **CAUTION:** Do not use the Press Focus Button without first disconnecting the connecting cord or removing the flash lamp.

When using a high speed electronic flash unit which does not have a built-in relay or solenoid merely connect its cord to the contact posts and cock the shutter in the normal manner. Do not cock the synchronizer cocking lever. The tube will then be flashed in synchronization with the shutter as the body release or shutter release lever is operated in the normal manner.

The contacts in these shutters are designed to operate electronic flashing units which are triggered by electronic means similar to the Thyratron or Strobtron tubes. It is not recommended that they be used with units using built-in relay triggering circuits.

When using high speed lamps be sure to follow carefully the wiring circuit or special instructions which may be given by the manufacturer of the lamp so as to insure proper synchronization and to avoid damage to the shutter.

Flash Synchronization With The Supermatic (X) Shutters

This type of shutter appears to be very similar to the fully synchronized Flash Supermatic Shutter except that it does not have the adjustment screw and extra cocking lever. The Supermatic (X) Shutter does not have the built-in mechanism for producing synchronization with standard flash lamps. It does have the two contact posts extending from the side of the shutter, and these are connected to an internal switch which is designed to provide instantaneous contact when the shutter blades reach the open position and is intended to be used for synchronization with high speed electronic flash units not incorporating a separate solenoid or relay. When using one of these units, connect its cord to the posts on the shutter and cock the shutter. The tube will then flash in synchronization with the opening of the shutter as the Body Release or shutter release lever is operated in the usual manner.

The contacts in these shutters are designed to operate electronic flashing units which are triggered by electronic means similar to the Thyratron or Strobtron tubes. It is not recommended that they be used with units using built-in relay triggering circuits. For full details concerning any such high speed unit be sure to obtain full wiring or circuit data from the manufacturer of the unit.

Do not attempt to fire standard flash lamps using the internal contacts of this shutter inasmuch as such lamps will not be fired in synchronization with the operation of the shutter. Synchronization with standard wire or foil filled flash lamps can be effected only through the use of a solenoid or other external syn-Pacemaker GRAPHIC cameras as there is no interference with the Body Release.

Correct Exposure

While the final goal of most photographers is a satisfactory print, the first aim of the camera user is a negative in which at least the main subject of interest is sharply defined and is of a density that will permit making a good print. This density will depend upon the light with which the subject is illuminated, the speed of the film, the processing the film is subsequently given, and upon the lens and shutter settings in relation to these quantities. Using a good exposure meter will simplify to a considerable extent the combining of the above factors to obtain the proper exposure. The price of one of the better photo-electric models will be repaid many-fold in good negatives and general satisfaction.

But the exposure meter will only go so far as to present you with a rather wide choice of lens apertures and shutter speeds, telling you that if you choose f/11 (for example) then you must set the shutter for 25 (1/25); or that if you wish to use 1/100 in order to stop some faster motion you must set the lens aperture to f/5.6.

“Increasing the shutter speed” means that a shorter exposure is given—as, for example, in changing from 1/50 to 1/100. In other words, the shutter passes light for a shorter length of time.

“A larger stop” or “opening up the lens” means that the actual diameter of the aperture of the lens is increased, and hence more light is passed by the lens in a given length of time. The smaller f/ numbers indicate larger apertures—f/8 being larger than f/16, f/3.5 larger than f/5.6, etc.

The relation between these combinations of aperture and shutter speed is really very simple, and knowing one of them is sufficient to give you any other. The rule is simply this: every time you open up the lens one stop (or one f/ number), double the shutter speed; and vice-versa.

For example, suppose the correct exposure would be 1/50 at f/16. If your subject is going to move, a speed of 1/200th may be needed to stop the action. You know that this will require opening up the lens, so you proceed to do so, counting as you go from stop to stop; starting at the next larger will be f/11, for which you double the speed—(going to 1/100th); the following stop is f/8, for which you double the speed again—(going to 1/200th). And there you have it: f/8 at 1/200th. The exposure meter dials will be found to bear the same relation between the combinations offered.

Like so many so-called “rules,” the above one also has an exception which applies to only some lenses at maximum aperture. Going from f/32 to progres-

sively larger apertures calling for a doubling of shutter speed as we go down the list, the ideal diaphragm scale would be marked:

f/32, 22, 16, 11, 8, 5.6, 4, 2.8, 2, 1.4, 1.

The lens on your new GRAPHIC probably has just these same stops indicated from f/32 to f/5.6. But, if its maximum aperture is f/4.5 or f/4.7, that figure will follow the 5.6 without being twice as fast; it is only about 50% faster and would therefore call for a 50% increase in shutter speed instead of the 100% set by our rule. A similar caution must be observed if you have an f/3.5 objective, as it will be marked at f/4 and f/3.5 even though the 2-to-1 exposure factor does not lie between these two apertures.

Any of these combinations which the exposure meter offers you will give the same density of negative; but the sharpness of the negatives and the amount of subject which will appear to be in good focus will vary with the exact combination you choose. The choice which the photographer must make will be a compromise between the need for stopping motion (calling for the higher shutter speeds and the larger lens apertures) and the desire to have the greatest amount of material in sharp focus (calling for smaller lens apertures and slower speeds).

Of the two, stopping motion is probably the more important since without it you may have a negative in which *nothing* is sharp; suggestions regarding it will therefore be given next. Finally, we shall consider the factors which control just how much of the scene (in addition to the object on which you actually focused) will appear sharp—assuming that all motion was stopped—and that goes under the heading Depth of Field.

Stopping Motion

If the subject you intend to photograph is moving, its image on the plate will likewise move. It will move some during even 1/1000th second, although only about 1/10th as far as it will during 1/100th second. All the photographer can hope to do is to give a short enough exposure so that the motion of the image on his film will not be objectionable. Just what constitutes "objectionable" depends both on the observer and upon the use to which the negative is to be put. A negative which is to be enlarged 10 times or to be printed in a magazine must be sharper than if it were to be reproduced in its original size. And a print which is apt to be examined through a reading glass must naturally be sharper than one to be seen from a distance only, as a highway billboard.

Not knowing precisely how his negative may be used, the average photogra-

pher must aim at "average acceptability," and it is on this basis that the following table has been compiled. It allows the photographer to take into account the four factors which are present at the time of his exposure: Namely, the focal length of his lens, the distance he will be from the subject when he releases the shutter, the velocity with which the subject will be moving at the instant of exposure, and the direction of its motion relative to the direction in which he is pointing his camera.

Suggested shutter speeds to stop motion at right angles to the camera when the subject moves 10 miles per hour.

		APPROXIMATE FOCAL LENGTH IN INCHES				
		4	5	6	7	8
DISTANCE FROM SUBJECT IN FEET	12	1/500	1/600	1/700	1/800	1/1000
	25	1/250	1/300	1/350	1/400	1/500
	50	1/125	1/150	1/170	1/200	1/250
	100	1/70	1/80	1/90	1/100	1/125

These speeds are only approximate, and have been "rounded off" to give numbers easy to multiply and divide. The need of greater accuracy is doubtful in view of the uncertain speed of the object to be photographed.

The above table applies to a subject moving 10 miles per hour at right-angles to the camera. In all probability your subject will be doing something different. If so, modify the shutter speed called for in the above table by the following rules:

*Double the speed of the shutter for double the velocity of the subject.

**Half the shutter speed for half the velocity.

*Double the shutter speed for half the distance to the subject.

**Half the shutter speed for double the distance.

*Double the shutter speed for double the focal length.

**Half the shutter speed for half the focal length.

Use one-third the shutter speed if the subject is coming directly toward you or going directly away from you.

Use two-thirds the shutter speed if it is coming or going at 45 degrees.

When in doubt, use the next higher speed.

*—1/100 instead of 1/50, for example.

**—1/50 instead of 1/100, for example.

The following table gives the approximate velocity with which some common objects might move. In using this table, it must be borne in mind that portions of the subject may move faster than the subject itself. For example: the arms and legs of a person walking or running; the oars of a boat; the wings of a bird; the spokes of an automobile or wagon wheel. Usually a higher shutter speed will be required completely to "freeze" an object than merely to stop its forward motion. This table is based on the rate of movement of the object as a whole.

- 5 mph. Pedestrians. Foliage in a light breeze. Rowboats.
- 10 mph. Children playing. Swimmers.
- 20 mph. Foot races. Boat races. Street traffic. Divers. Jumpers. Football and Baseball games. Sail boats.
- 40 mph. Horse races. Highway traffic. Power boats.
- 60 mph. Trains. Motorcycle races. Birds in flight.
- 100-300 mph. Airplanes. Auto races.

Depth of Field

Although we may focus most precisely on a certain portion of an object, we all know that things slightly nearer to the camera as well as some slightly farther away will also appear sharp in the final print. The field of sharp focus extends farther behind the object than in front. This range of distances within which all objects *appear* equally sharp is called the depth of field.

As in the case of stopping motion considered in the preceding paragraph, our acceptance of sharpness will depend upon the nature of the print and how it is viewed; and the sharpness to be demanded of a negative for making such prints must depend upon the amount of enlargement contemplated. Depth of Field, therefore, is not a precise physical quantity which can be measured. Lens manufacturers put out more or less complicated tables under the heading "depth of field," or less correctly "depth of focus," which some photographers find useful. The great majority of camera users, however, find the following easily-remembered facts enough of a guide for all practical purposes.

1. *The greater the distance to the object focused on, the greater the depth of field for a given focal length and relative aperture.*
2. *The greater the focal length of the lens, the less the depth of field at a given relative aperture and distance.*
3. *The greater the lens aperture (the smaller the f/ number), the less the depth of field for a given focal length and distance.*
4. *The sharp field is deeper behind the object than in front of it.*

If you want the greatest possible amount of material to appear sharp in your picture, stop the lens down as far as you can without requiring an exposure time so long that movement becomes objectionable. If, on the other hand, you wish to minimize the background or nearer objects by purposely throwing them out of focus, open up the lens to one of its larger apertures. If you want the maximum sharpness of the precise point on which you focus without regard to what is nearer or farther away, choose a lens aperture approximately half way between the greatest and the smallest which your lens can give.

Front Movements

In general, when it is desired to photograph an object higher than your head, you point the camera upward; and when something to one side attracts you, you turn the camera in that direction. If the subject (such as a building) happens to have a flat vertical surface, the resulting negative is apt to show an unwanted converging of lines which you know are parallel (rows of windows or the sides of the structure, for example). This is the phenomenon which makes some photographs of tall buildings look as though they were leaning backward. This is not "distortion" but a true rendering of linear perspective—even though it may not always be pleasing.

Although the linear perspective can be altered greatly during subsequent enlargement of the negative, it is often desirable to minimize the effect as much as possible in the original exposure. This can be done by keeping the back of the camera (the film) as nearly parallel as possible to the surface being

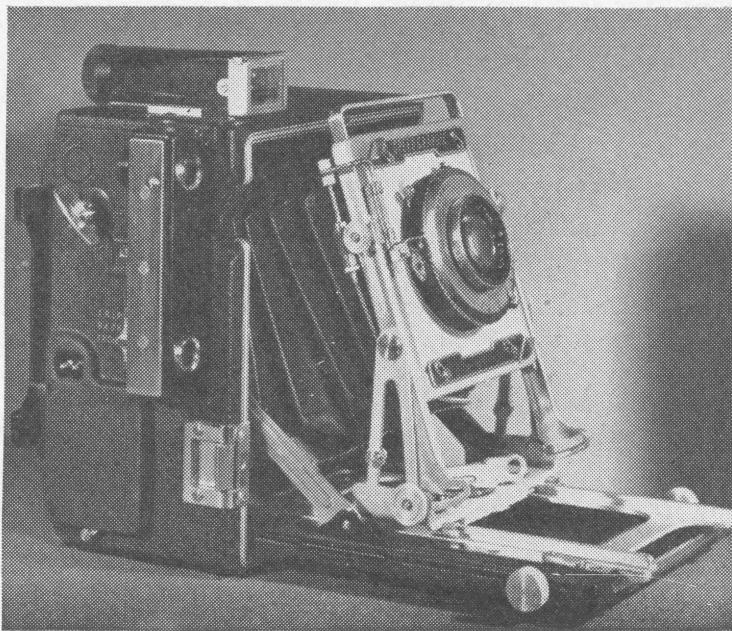


Fig. 14. Front raised and tilted back.

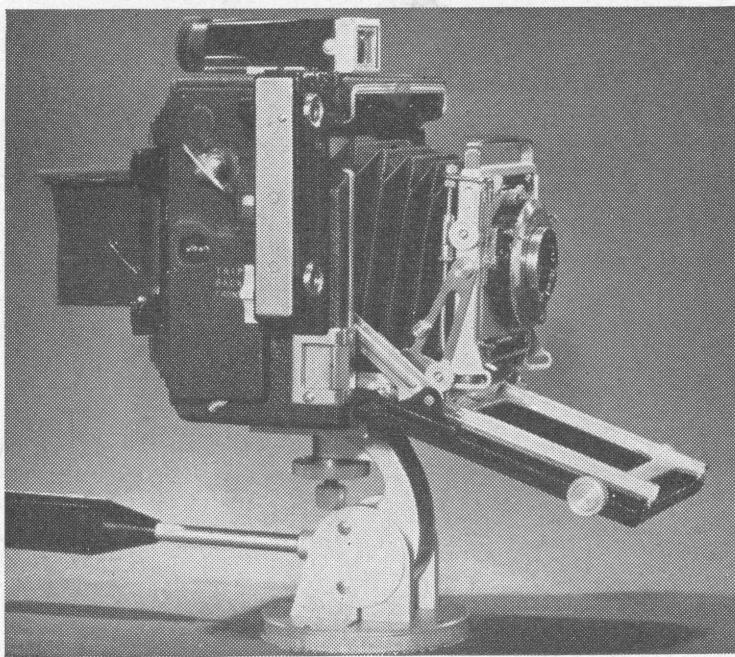


Fig. 15. Bed dropped, front standard tilted back to provide drop front.

photographed, and by then bringing into the field those parts slightly higher or to one side by shifting the lens up or sideways without moving the rest of the camera.

Your Pacemaker GRAPHIC camera is fitted with an entirely new front standard, the basic part of which is a stainless steel U-shaped member which rides on the sliding track and carries the moveable front standard frame with the lensboard and lens. Provision has been built into this front standard to allow vertical, lateral, and tilting movements of the lens.

To raise the lens vertically loosen the knurled nuts at the center of each side of the front standard. These are the rising front lock nuts. The entire front frame may then be lifted vertically and held at any desired position by tightening the lock nuts. The front standard may be shifted to either side, parallel to the plane of the film, after releasing the front standard lock (finger pull) and depressing the lateral shift catch directly below it. A new movement built into the Pacemaker GRAPHIC cameras makes it possible to tilt the lens backward. This is accomplished by loosening the two tilt lock nuts on each side of the base of the front standard. This will allow the lens frame to be tilted backward as much as 18° about the optical axis of the lens. See Figure 14. When the front bed of the camera has been dropped (see page 36) this degree of tilt of the lens corresponds exactly with the drop of the bed and in effect produces a vertical drop of the lens itself. By using these two movements in combination almost any desired up or downward tilt for controlling focus

may be accomplished. When photographing a room or large horizontal area from an elevated position the downward tilt is especially helpful in bringing the entire field into sharp focus on the ground glass even when a large diaphragm opening is used. Of course, the ground glass should always be used when the front is moved from its normal position.

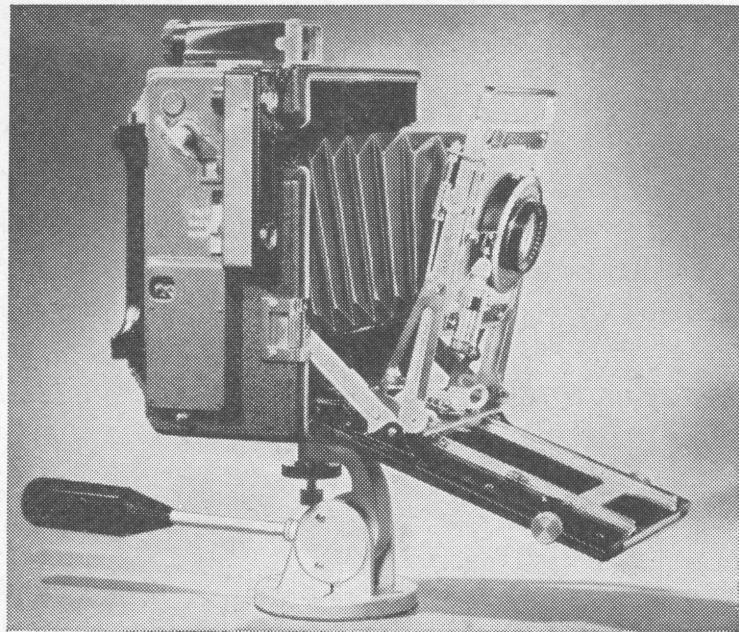
Before making an exposure, the lens should be locked in its optimum position by tightening the various controls mentioned above. Before any attempt is made to return the front standard to the camera body (as in preparation for closing the camera) the lensboard *must* be brought back to its normal position and locked in place.

Lenses and Lensboards

The Pacemaker GRAPHIC cameras are designed to accept a wide variety of lenses either in barrel or in shutter. Generally speaking, wide angle and normal focal length lenses will be mounted in a shutter whereas telephoto lenses will be mounted in barrel. The lens barrel or the shutter contains a diaphragm, and full information concerning the use of the diaphragm will be found in the section of this booklet under the heading *Exposure*.

The lens or shutter will be held firmly to the lensboard by means of a flange or lock ring attached to the back of the lensboard. If additional lenses are desired your GRAFLEX dealer can supply you with suitable lensboard kits prepared for currently listed lens and shutter combinations. These kits will in-

Fig. 16. Bed dropped, lensboard tilted forward and raised for controlling focus.



clude the precision-cut metal lensboard, and if needed, light-tight washers for the shutter locating pin as well as the necessary shutter release arm to allow the use of the body release.

Interchangeable lensboards, obtainable from your GRAFLEX dealer, may also be fitted with Solenoid releases to provide flash synchronization.

Lensboards are held in place on the Pacemaker GRAPHIC cameras by means of slide locks at the top and bottom. Note that each lensboard has a set of two raised lock pads at the top and bottom. These should be placed at the top and the bottom of the opening in order to make sure that the slide locks will hold the lensboard firmly in position and parallel with the back of the camera. To remove a lensboard, move the slide lock outward in the direction of the slot. The lensboard may then be pulled forward. It should be noted that *both* slide locks must be moved in order to allow the removal or fitting of new lensboards to the new Pacemaker GRAPHIC cameras.

To photograph large objects at close range, you can use a wide angle lens which is an objective of relatively short focal length but is specially designed to cover a large negative area. The image of these objects will be smaller at a given distance with a wide angle lens than with a normal lens, but there will be a wider field of view.

For a larger image of objects at a distance, use a long focal length lens such as a telephoto lens. These lenses require a bellows extension of only about one-half their listed focal length. Thus lenses with a focal length of 10 inches may be used very easily on a camera equipped with a bellows extension of less than 9 inches. Needless to say, the field of view of a long focus or a telephoto lens is much narrower than that of a normal focal length lens.

If the lens is mounted in a shutter it will be found that the shutter cannot rotate on the lens board. It is held firmly in place by means of a locating pin fitting into a hole in the lensboard. Should it be necessary to remove the shutter from the lensboard, first remove the flange or lock ring from the back of the lensboard. Note that there are small felt washers around the locating pin of the shutter. Do not lose these as they must be replaced around the locating pin when the shutter is fitted to the camera in order to prevent the entrance of light at that point.

Coated Lenses

The coating of lenses is one of the most recent accomplishments in the optical industry. A coated lens will have a brownish-purple color on the surface. This color is similar to the tarnish or iridescent color that was previously considered

detrimental in lenses. The process of coating deposits a metallic salt, such as magnesium fluoride, on the surface of the lens in an extremely high vacuum.

The coating of lenses is done only on the air glass surfaces and not on the cemented surfaces. The advantages of coating photographic lenses are an increase in transmitted light by a reduction in light loss caused by internal reflections, a definite increase in brilliance or contrast of the image, and the minimizing of flare spots due to multiple reflections within the lens. Every surface of a lens that is coated will increase the light transmission. However, with most standard lenses, this increase in light transmission will not be noticeable due to the exposure latitude of most of the films currently available. The added brilliance due to the coating of the lens surfaces should be noticeable and should result in finer photographs. This is especially true when using color film.

The coating which is now being applied to lens surfaces is almost as hard as the average optical glass. While no special precautions are necessary for cleaning the surfaces of coated lenses, they should be handled as carefully as all fine lenses. All surface grit and dust should first be removed with a soft camel's hair brush before the lens is cleaned with a fine lens tissue or a soft cloth such as a well-laundered linen handkerchief. Do not apply pressure on the cloth. Simply breathe on the surface of the lens and wipe gently with easy circular motions. If a lens cleaning fluid (only those specifically recommended by lens manufacturers) is to be used, do not apply it directly on the lens surface. Instead place a drop or two on the lens tissue or cloth and wipe the lens with the moistened material.

Telephoto Lens

For a larger image of objects at a distance use a long focus lens or a telephoto lens. While it produces a larger image, the field of view of a long focus or a telephoto lens is smaller than that of a lens with a normal focal length. Accessory telephoto lenses for your camera may be in a form of attachments or complete photographic objectives. If the former, complete instructions will accompany them. The latter are often preferable because their special design is such that they require a bellows extension of only approximately one half their listed focal length. These telephoto lenses may be used in the same manner as the lens now fitted to the camera for they are supplied with standard diaphragm openings producing exactly the same exposure as the openings marked on standard lenses.

The use of a telephoto lens may require moving the front standard of the camera forward from its normal position. This is simplified by the hinged

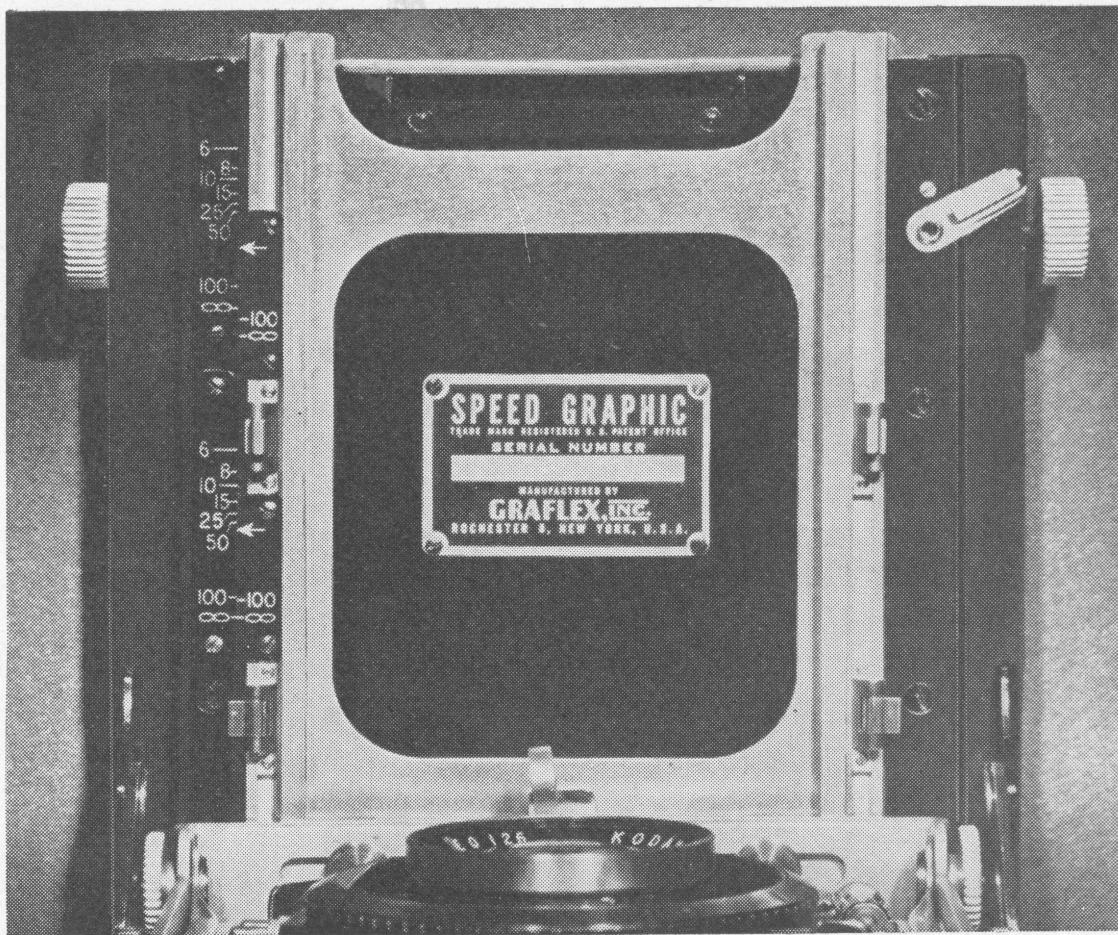


Fig. 17. Bed with Dual Sets of Scales and Infinity Stops.

infinity stops which allow the front standard to be drawn out to any desired position on the sliding track. For full instructions covering this adjustment, refer to the section on double extension bellows (page 35). It is well to note that your GRAFLEX dealer can arrange to have your camera fitted with focusing scales and infinity stops for telephoto lenses. See figure 17.

Long Bellows Extension

When working with long focal length objectives or with a normal lens at close distances, it is sometimes desirable to extend the front standard beyond the point permitted by the pre-set infinity stops and the available track extension. If you wish to continue to use the camera in the normal manner by utilizing the rangefinder and focusing scale it is quite essential that the infinity stops be left in the original position.

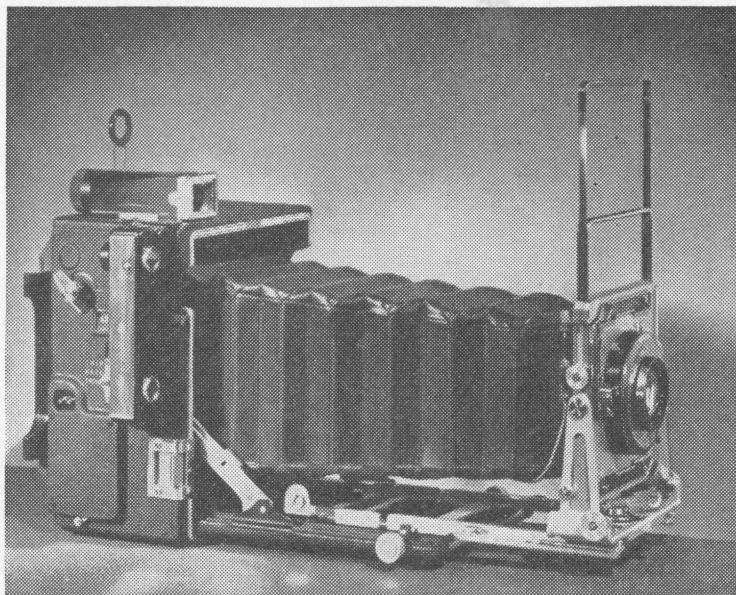


Fig. 18. Double Extension Bellows.

The new design of the infinity stops will allow the upper member to be swung outward and down thus allowing the front standard to be drawn forward to maximum bellows extension as desired. Additional sets of infinity stops may be fitted as shown in Figure 17.

The rangefinder may be used with the focusing scale for the standard lens to determine the distance to the subject. This reading can then be transferred to the scale for the longer lens allowing it to be set by scale focusing.

Double Extension Bellows (Close-up Photography)

When using the camera for close-up photography, the lens is placed at a greater distance than normal from the focal plane (film position). This will necessitate a change in the exposure, since the f/ values engraved on the shutter are based on a relationship existing only when the lens is at the infinity position. For close-up photography, your exposures should be determined in accordance with the following table. The lens-to-film distance (bellows extension factor) can be determined approximately by measuring from the diaphragm-control ring of the lens or the center of the shutter to the plane occupied by the film (the ground glass).

Ratio of Image to Object	Bellows Extension Factor	Exposure Factor*
1:8	1.125	1.265*
1:4	1.25	1.56*
1:2	1.5	2.25*
1:1.5	1.75	3.06*
1:1	2.	4*

*Increase your exposure by the indicated amount, just as when using a filter having the same factor. For instance, if the factor is 2, expose twice as long—1/5 second instead of 1/10 second.

For black-and-white photography with standard films, you will find that the latitude of the film will generally compensate for much of the change in exposure so that no allowance for extension will be required unless copying close to full-size (1:1). However, for color photography, we would recommend that you follow this table very closely because of the limited latitude of color materials.

The Wide-Angle Lens (Drop Bed)

A wide-angle lens is one of special design such that while it has a very short focal length and is thus placed close to the film, it will still adequately cover a negative area greater than that covered by a lens of standard design. When placed close to the film it includes a wider angle of view and is likely to include the front bed of the camera.

The new Pacemaker GRAPHIC cameras may be fitted with focusing scales for wide-angle lenses. In order to use any focusing scale, it is necessary to establish a constant reference point. Because of the location of the rangefinder control cam and bracket on the right side of the sliding track, there is space for only one infinity stop and it can be placed in the left rear section of the sliding track within the camera body. To use the infinity stop for the wide-angle lens move the front standard forward and rack the track out as far as it will go. Then lift the hinged member of the infinity stop upward and move the front standard back against it. Because of the proximity of the bed brace, it may be found more convenient to lift the stop upward by reaching between the bed brace and the body of the camera. In order to make sure that the front standard has been positioned squarely with respect to the film after it has been moved back against this infinity stop, hold the side of the front standard against the left side of the camera track and then lock it in place with the front standard lock. The lens will then be found to be positioned properly with respect to the film plane. This can be checked by examining the image on the ground glass focusing screen at the back of the camera.

Your Pacemaker GRAPHIC camera has a special drop bed. With the sliding track racked all the way into the camera body, press downward on both of the bed braces. This frees them from the recesses into which they sprung to hold the bed in its horizontal position, and a slight downward pressure applied to the bed will bring it to the point where the braces will snap into a lower set of notches. See Figure 19. With the bed in this position and the front standard properly set against the wide angle lens infinity stop, critical focusing and composition are accomplished on the ground glass through the use of the

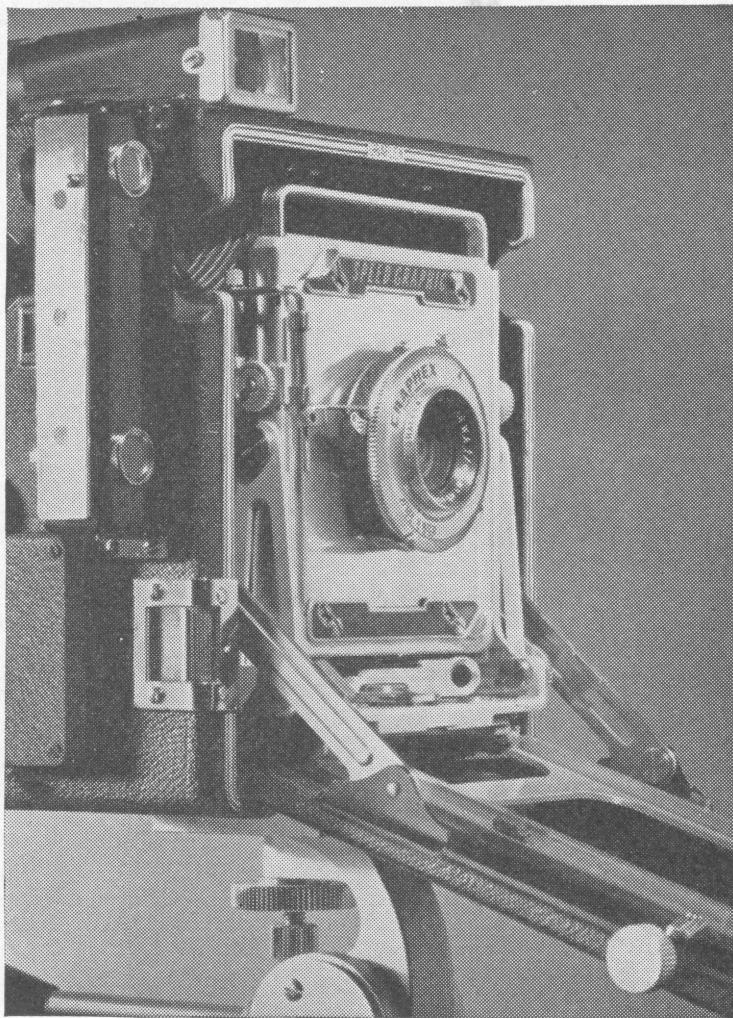


Fig. 19. Bed dropped, wide-angle lens in position.

NOTE: *Do not raise or lower the bed unless the sliding track is racked all of the way back.*

focusing knobs in the normal manner. This is possible because the camera has the linked track.

CAUTION: Before raising the bed of the camera by depressing the bed braces and allowing the bed to move upward, **be sure that the sliding track is racked all of the way back.** Also be sure to swing the wide angle infinity stop downward before attempting to slide the front standard back into the camera body when closing the camera.

Film and Plate Attachments

Film Pack Adapters, Holders for sheet film, (cut film) and plates, as well as Magazines for sheet film, are available for use with the GRAPHIC cameras. The Magazine, however, is usable only with cameras having the GRAFLEX Back. It is described in detail in the special instruction pamphlet which accompanies it.

Blowing or brushing out the empty holders before loading will help prevent the occurrence of "dust spots" in the finished negative.

Film Pack Adapter

The Film Pack Adapter can be loaded or unloaded in full daylight, but the direct sun should be definitely avoided; and deep shade becomes more essential as higher-speed films are used. Always make sure that the slide is inserted before the Adapter is removed from the camera.

To load the Film Pack Adapter, open its hinged back by first releasing the pair of catches located at the edge nearest the slot (the edge from which the slide can be withdrawn). Then insert the metal film pack, handling it by its edges, so that its paper tabs protrude through the slot in the Adapter when the hinged back is closed, and so that the aperture in it faces the aperture in the front of the Adapter. Caution should be taken to center the tabs in the tab gate before closing the Adapter. (Save the paper and metal foil in which this film pack was wrapped so that it may again be protected from light as soon as it is removed from the Adapter).

Before the first exposure can be made the outside tab (bearing the number 0) must be withdrawn and torn from the pack. Further instructions accompany each pack. After the last tab (number 12) has been pulled, the exposed film pack is somewhat self-protected and may be removed from the Adapter. *Handle it only by its edges. Re-cover it with its foil wrapping and return it to the box.*

Sheet Film Holders

Loading or unloading a sheet film holder should be done only in total darkness; in order to acquire the skill necessary for this, you may wish to practice in the light with a piece of exposed film.

To find the emulsion side of a piece of sheet film in the dark, note the position of the notches cut along one of its shorter edges. The notches are so placed that when they are on the right side of the top edge, the emulsion side will be facing you. Always handle the film by its edges and never touch the front (emulsion) surface.

To load a sheet film holder, first remove the slide. Now, while folding the bottom retaining edge of the holder out from the position which it occupied when the slide was in place, slip the piece of sheet film in under the two film-retaining guides so that the emulsion side will be next to the slide when it is replaced. It will facilitate insertion of the film if you bow it slightly. After the film has been slid into the holder as far as it will go, the hinged bottom edge

of the holder can be returned to its normal position. If the bottom retaining edge does not seat smoothly, the film has not been pushed under the upper guide at the other end.

Replace the slide after the film is properly inserted. Rotatable catches are provided to prevent unintentional withdrawal of a slide.

Raised dots on the bright side of the slide handle can be used to identify exposed and unexposed films. Load the holder with the dots on the outside, and after exposure replace the slide with dots facing in. By following this universal code carefully, double exposures will be prevented.

To unload the holder, the reverse procedure is followed.

Fitting Holders To The Camera

Accessories such as the GRAPHIC holders are inserted in the GRAPHIC Back in the opening presented when the focusing panel is separated from the main body of the camera, by drawing back on its two ears. The holder should be held by its sides and pushed in until its raised edge drops into the recess in the back of the camera; this insures a light-tight fit and eliminates the possibility of drawing the holder out of the camera as the slide is removed.

To remove the holder, insert the slide, pull the holder slightly away from the back of the camera at the handle end, and push the other end with the left hand. It then comes out very easily.

GRAFLEX film and plate attachments are loaded in the same manner as the corresponding GRAPHIC accessories. The GRAFLEX film magazine is supplied with its own special instruction booklet. Like the GRAFLEX focusing panel, this type of film attachment is held in place on the camera by the retaining strips at the bottom and at the top. Move both of these all of the way to the right in order to allow the focusing panel to be removed and replaced by the film attachments. After fitting these accessories to the camera, make sure that both slide locks are pushed to the left as far as possible.

The Tripod Socket

The Pacemaker GRAPHICS are equipped with special tripod sockets. The basic parts built into the camera have a 3/8-16 thread permitting the use of the camera on professional and continental type tripods. Inside of this part is a small bushing with the standard American 1/4-20 tripod thread. If for any reason the threads on this bushing should become stripped or badly worn it may be easily replaced. While it is locked in place when shipped from the factory, a drop of alcohol placed in the space between the two parts will

loosen the adhesive holding them and allow removal of the bushing by a large screwdriver.

Two tripod sockets are provided. The one for vertical pictures is located under the handle which may be unsnapped and swung clear. The other socket is in the bottom of the camera body.

Closing the Camera

First rack the track **all of the way** into the camera before sliding the front standard into the camera. Depress the bed braces and swing the bed up until it locks securely.

Care And Servicing Of The Camera

The lenses must be kept clean at all times. *Never touch the glass of a lens with the fingers. Finger prints corrode the highly polished surfaces and ruin the objectives.* A soft brush, such as goes under the name "camel's hair," is usually sufficient for removing dust and lint from lenses, and a small rubber ear syringe is also handy for blowing off dust. If additional cleaning seems to be called for, use tissue made for that purpose; or if this is not available a soft, freshly-laundered unstarched unused linen handkerchief. Breathing on the lens before applying the tissue is accepted as good practice, but the use of household cleaning fluid should be avoided. Never unscrew the lens elements from the shutter; under normal conditions cleaning of the inside surfaces will be unnecessary.

Shutters contain springs that regulate their speed, and these should not be left in their stressed or cocked position over long periods of time. The front shutter should always be released before putting the camera away and it is a good idea to turn the shutter speed ring to one of the lower settings. The focal-plane shutter should also be allowed to run down to the full open or even the fully closed position. **Never oil a shutter.**

An occasional small drop of fine machine or sewing machine oil may be placed on the slide of the front shutter release. This is the vertical bar to which the shutter release arm is fastened. Do not oil or otherwise lubricate the cable release. It was factory packed with a special lubricant and requires no further attention.

Handle Your Camera Carefully

A fine camera is primarily an instrument rather than a machine. While GRAFLEX products have won a reputation for sturdiness and continued functioning under adverse conditions, this should in no sense be considered an invitation to abuse the equipment. Your Pacemaker GRAPHIC camera has

been carefully constructed and with proper care will give the type of performance which is rightfully to be expected from high grade photographic equipment. Although it is strong enough to withstand normal shock incident to shipping and actual use, it should be handled with proper care so as to avoid injuries to the more sensitive parts such as the lens, shutter, and rangefinder. More damage is probably done by people handling equipment with which they are not familiar than by the normal wear of service. To insure long and trouble-free service from your camera, follow these instructions carefully as you handle it for the first time. Above all do not twist any knobs or push any buttons on the camera until you know what this booklet tells about them. Do not lend your camera to anyone not familiar with it or without instructing him thoroughly on how to use it. Should you lose this booklet or desire additional copies, obtain them from your GRAFLEX dealer or your nearest GRAFLEX Service Dept.

Emergency Attention

While it is recommended that all servicing of the camera should be accomplished only by a trained camera repair man at one of the GRAFLEX authorized service depots it may occasionally be necessary to make emergency adjustments in the field. On the back of the front standard board two small cams will be found. Should the front standard of the camera be bent out of line, these can be turned in such a way as to allow the front standard to be squared again by checking the image of some clearly defined target on the ground glass at the back of the camera. Be sure that the target is perfectly parallel to the ground glass. These cams have been carefully pre-set at the factory and should not be adjusted unless found absolutely necessary.

If the rangefinder appears to be out of synchronization the manufacturer's instruction manual may help you to make the necessary adjustments. Above all make only one adjustment at a time and check all instructions very carefully.

Because the infinity stops on the Pacemaker GRAPHIC cameras are held in place by special cone pointed screws forced into a hole drilled into the track, they are not readily adjustable for slight movements. They may be reversed—left to right—if necessary, but we recommend that under other circumstances they be moved at least .030". We do not recommend their being moved at all, except under exceptional circumstances and preferably by only a competent camera serviceman.

Any adjustment of the built-in body release or the cable release should be attempted only by a skilled camera repair man.

PROVISION FOR

—WITH PACEMAKER SPEED GRAPHICS “23” “34” “45”

2 $\frac{1}{4}$ x3 $\frac{1}{4}$ 3 $\frac{1}{4}$ x4 $\frac{1}{4}$ 4x5
Speed GRAPHIC Cameras

(A) Between-the-lens (front) shutter
(Full Built-in Synchronization)
S-731 and S-722 and S-75
S-83 and S-93

(A) Between-the-lens (front) shutter
(“X” Type with Accessory Solenoid)
S-831 and S-857 and S-858
S-931 and S-957 and S-958

Synchronizer Control Setting

“M” or “20”

General Electric
No. 5, No. 5B, No. 11, No. 22,
No. 22B

Westinghouse
No. 5, No. 5B, No. 11, No. 22,
No. 22B

Wabash
Press 25, Press 40, Press 50,
No. 0, No. 25B, No. 2, No.
2B, No. 3, No. 3B.

“F” or “5”

General Electric “SM”
Westinghouse “SM”
Wabash “SF”

“X” or “0”

Electronic Flash Units Utilizing a Vacuum Tube Relay in the Triggering Circuit

NOTE: Not for Electronic Flash Units with Mechanical Relay.

Method of Firing:

“Solenoid”

General Electric
No. 5, No. 5B, No. 11, No. 22,
No. 22B

Westinghouse
No. 5, No. 5B, No. 11, No. 22,
No. 22B

Wabash
Press 25, Press 40, Press 50,
No. 0, No. 25B, No. 2, No.
2B, No. 3, No. 3B.

Electronic Flash Units with Mechanical Relay

“X” Setting
(Built-in Contacts)

Electronic Flash Units Utilizing a Vacuum Tube Relay in the Triggering Circuit. These contacts are not for use with Electronic Flash Units with Mechanical Relay

(B) Focal Plane (Back) Shutter (“23”)

S-731 and S-722 and S-75

Speed Settings:

1/250, 1/500, 1/1000

Flash Lamps Usable:

General Electric
Westinghouse
Wabash

No. 31
No. 31
No. 2A

(B) Focal Plane (Back) Shutter (“34” and “45”)

S-83 and S-831 and S-857 and S-858
S-93 and S-931 and S-957 and S-958

Speed Settings:

1/250, 1/500*, 1/1000

Flash Lamps Usable:

General Electric
Westinghouse
Wabash

No. 31
No. 31
No. 2A

*See page 17

THE USE OF FLASH

—WITH PACEMAKER CROWN GRAPHICS "23" "34" "45"

2 $\frac{1}{4}$ x 3 $\frac{1}{4}$ 3 $\frac{1}{4}$ x 4 $\frac{1}{4}$ 4x5
Crown GRAPHIC Cameras

(A) Between-the-lens (front) shutter
(Full Built-in Synchronization)
C-731 and C-722 and C-75
C-83 and C-93

(A) Between-the-lens (front) shutter
("X" Type with Accessory Solenoid)
C-831 and C-857 and C-858
C-931 and C-957 and C-958

Synchronizer Control Setting	Flash Lamps Usable:	Method of Firing:	Flash Lamps Usable:
"M" or "20"	General Electric No. 5, No. 5B, No. 11, No. 22, No. 22B	"Solenoid"	General Electric No. 5, No. 5B, No. 11, No. 22, No. 22B
	Westinghouse No. 5, No. 5B, No. 11, No. 22, No. 22B		Westinghouse No. 5, No. 5B, No. 11, No. 22, No. 22B
	Wabash Press 25, Press 40, Press 50, No. 0, No. 25B, No. 2, No. 2B, No. 3, No. 3B.		Wabash Press 25, Press 40, Press 50, No. 0, No. 25B, No. 2, No. 2B, No. 3, No. 3B.
"F" or "5"	General Electric "SM" Westinghouse "SM" Wabash "SF"		Electronic Flash Units with Mechanical Relay
"X" or "0"	Electronic Flash Units Utilizing a Vacuum Tube Relay in the Triggering Circuit	"X" Setting (Built-in Contacts)	Electronic Flash Units Utilizing a Vacuum Tube Relay in the Triggering Circuit. These contacts are not for use with Electronic Flash Units with Mechanical Relay
NOTE: Not for Electronic Flash Units with Mechanical Relay.			

Summary of Lens and Shutter Combinations

731	Camera, 101MM GRAFLEX Optar in No. 1 GRAPHEX Synchronized Shutter
722	Camera, 101MM KODAK Ektar in No. 1 Flash SUPERMATIC Shutter
75	Camera, 105MM KODAK Ektar in No. 2 Flash SUPERMATIC Shutter
83	Camera, 135MM GRAFLEX Optar in No. 2 GRAPHEX Synchronized Shutter
831	Camera, 135MM GRAFLEX Optar in No. 2 GRAPHEX "X" Shutter
858	Camera, 127MM KODAK Ektar in No. 2 GRAPHEX "X" Shutter
857	Camera, 127 MM KODAK Ektar in No. 2 KODAK SUPERMATIC "X" Shutter
93	Camera, 135MM GRAFLEX Optar in No. 2 GRAPHEX Synchronized Shutter
931	Camera, 135MM GRAFLEX Optar in No. 2 GRAPHEX "X" Shutter
958	Camera, 127MM KODAK Ektar in No. 2 GRAPHEX "X" Shutter
957	Camera, 127 MM KODAK Ektar in No. 2 KODAK SUPERMATIC "X" Shutter

C. Crown S. Speed

Your **GRAFLEX Dealer** stands ready to assist you in answering questions pertaining to the camera and its use. You will find that over-the-counter discussion of your pictures or the use of the camera will be very helpful to you. Remember that **GRAFLEX** products are handled through these dealers throughout the country and orders for parts or accessories should always be placed with your nearest **GRAFLEX** dealer.

The **GRAFLEX Service Sales Departments** are equipped to inspect, clean, and adjust all **GRAFLEX** products, and to fit accessories and special lenses to **GRAPHIC** and **GRAFLEX** cameras. While all correspondence on the subject should be addressed to the Service Department nearest you, your **GRAFLEX** dealer will be glad to take care of the details of packing and shipping any equipment to be sent in for attention.

The **GRAFLEX Technical Service Department** is anxious to help you get the most out of your **Pacemaker GRAPHIC** camera. Do not hesitate to write to us about any photographic problem which you may have. When your questions relate to the actual making of pictures please be sure to send in your negatives and such exposure data as you may happen to have available.

The registration card packed with your camera when it left the factory, should be filled out completely and returned to us promptly. It furnishes us with information that facilitates answering your letters and also entitles you to a year's free subscription to the interesting and informative **GRAFLEX** owner publication "**GRAPHIC GRAFLEX News**". If you did not receive a registration card with your camera, write for one today.

The serial number of your camera will be found stamped into the name plate attached to the bed of the camera. Always give this number when corresponding with reference to your camera.

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